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THE MANAGEMENT OF CHEST WOUNDS

Collective Review

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THE chest, forming such a large and exposed part of the body and containing such vital structures as the heart and lungs, is particularly vulnerable to trauma. While in civil practice grave thoracic injuries are relatively infrequent, in military practice chest wounds assume serious and significant importance. This is clearly emphasized by numerous statistical reports. Reviewing war wounds in 11,000,000 men of English, French, American, and German nationalities, Hoche (210) found that the chest was involved in 6 per cent and was preceded in frequency of involvement only by the limbs and the head, face, and neck. The total mortality in this series was 8 per cent, whereas that in the chest wounds was 56 per cent and second only to that of abdominal wounds (68 per cent). In reviewing the cause of death among 12,350 killed, Hoche also found that the distribution of the wounds according to body region was: head, 47 per cent; thorax, 20 per cent; abdomen and pelvis, 11.8 per cent; and limbs, 9.9 per cent. Soltau (404) found that during the last World War, chest wounds comprised about 3.5 per cent of all casualties admitted to the casualty clearing stations. In the American Army during the World War (1917–1918) there were 174,296 admissions resulting from battle injuries, poison gases excepted (282). Among this number, the thoracic region was involved in 4,595 cases (2.6 per cent), being preceded in frequency of involvement only by the limbs and the head and face. While the total mortality was 7.73 per cent, that of chest wounds was 24.05 per cent. In the recent Spanish Civil War, Trueta (433) found that of 9,850 patients treated in different hospitals in Barcelona, 12.1 per cent had thoracic injuries, an incidence second only to that of injuries of the limbs. Sauerbruch (374) stated that of 300 soldiers dying on the battlefield, 37 per cent showed wounds of the chest. Similarly, among 469 dead on the battlefield, Loeffler (265) found chest injuries in 29 per cent. According to Crafoord (95), chest wounds cause from 30 to 40 per cent of all fatalities in war. The mortality of chest wounds inflicted during warfare varies according to different authors but the proportion of chest wounds to all others, even in past wars, seems to bear a remarkable uniformity. According to Ranson (351), 1 wound in every 12 is of the chest. In the Sino-Japanese War, he found that chest wounds constituted 9.7 per cent of the total admissions to a base hospital in Shanghai. Obviously considerable difficulties exist in the attempt to estimate the number of fatalities in the field due to chest wounds. A number of observers have given figures of well over one-third of the total killed (85, 95, 162, 228, 265, 351, 374, 384).

That definite progress has been made in the management of war wounds of the chest is revealed by the decreasing mortality statistics quoted by Ranson (351) for various wars since the Crimean. In this conflict the English lost 79.2 per cent; the Americans in the War Between the States, 62.6 per cent; the Germans in the Franco-Prussian war, 56.7 per cent; the British in the last world war, 27.5 per cent; and the Chinese in the current Sino-Japanese war, 14.8 per cent. It is perhaps too early to obtain estimates of this nature in the present great conflict. In the last World War the mortality statistics for patients admitted with chest wounds varied considerably and depended to a great extent upon the source of material. Thus, the mortality was very high

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in the advanced dressing stations and ambulances and decreased progressively with regression to the base hospitals. This is readily comprehensible and is demonstrated by the statistics of a number of authors. Duval (115–119) gave a mortality of about 30 per cent at the dressing stations; 25 per cent in the ambulances; and 15 per cent in army hospitals. Somewhat similar figures have been reported by others (113, 162, 172, 328, 329). Duval (115) found a general mortality of 20 per cent in a collected series of 3,453 cases of chest wounds sustained during the last war and reported by thirty-seven authors. As statistical figures upon chest wounds during the last World War may be found in the reports of numerous others (134, 152, 160, 201, 263, 264, 290, 367), no useful purpose is gained by quoting these further. The statistics presented on the frequency and mortality of chest wounds in warfare clearly emphasize the significance of such injuries and justify their serious and timely consideration.

Although the fundamental principles involved in the management of chest wounds occurring in civil life may be applicable to those occurring in military practice, considerable differences exist in these two types of injuries and in the problems respectively entailed. In general, chest wounds in civil life are less extensive and less severe than those occurring in warfare. Such wounds in civil life are most commonly produced by knives, ice-picks, and pistol bullets, whereas in warfare the more extensive damaging effects of shell fragments, shrapnel, and explosive blasts are usually observed. In an analysis of 1,187 patients with chest wounds admitted to the Grady Hospital in Atlanta, Boland (50, 51) found that 1,009 (85 per cent) of the wounds were penetrating and 162 (15 per cent) were non-penetrating. Of the former, 79 per cent were stab wounds and 21 per cent were gunshot wounds. Empyema and other serious infections occurred in less than 20 per cent of the cases. Of his series of 553 cases Elkin (130) observed that 354 (62.2 per cent) were stab wounds produced by the "switch blade" knife, 93 (16.8 per cent) were produced by the ice pick, 84 (15.2 per cent) were the result of pistol bullets, 18 (3.2 per cent) were due to the shotgun, and the remainder (4) were caused by nails, splinters, and automobile accidents. Infection occurred in only 1.4 per cent of the cases. During the five-year period ending in 1936, 2,091 patients with chest wounds were admitted to the Charity Hospital in New Orleans and of this number only 13.8 per cent had definite evidence of hemothorax (80). The majority of these cases were due to stab and gunshot wounds and only 2 patients had crushing injuries. It was estimated that infection occurred in 1.4 per cent of the chest wounds admitted during this period. The relative infrequency of severe crushing injuries of the chest is further demonstrated by the fact that among 16,000 cases admitted to the accident room in this institution only 75 were injuries such as follow automobile accidents (352). These statistics demonstrate clearly that in civil life chest wounds are most commonly of the stab or closed penetrating type in which extensive tissue injury, disturbance in cardiorespiratory physiology, and the development of infection are minimal. For these reasons chest wounds occurring in civil life are more readily adaptable to conservative management. On the other hand, chest wounds occurring in warfare are most commonly produced by such agents which cause extensive tissue damage and result in open pneumothorax. Consequent hemorrhage, shock, and marked disturbances in cardiorespiratory physiology are more frequent. Foreign-body retention and contamination with bits of clothing, dirt, and débris increase the incidence of infection. For these reasons operative intervention is more frequently necessary and usually indicated earlier. Moreover, in the present conflict, in which the keynote of warfare is perfection of mechanization and mobility, the problem of administering first aid and the collection and the transportation of the wounded increase the difficulty of adequate management (89, 358, 433). Of interest in this connection is the increasing significance that air transportation of the wounded is assuming (10, 245).

It is beyond the scope of this presentation to complete an extensive review of the literature on this subject. While this review is concerned primarily with the management of chest wounds in general, partial emphasis will be applied to those occurring in warfare and especially in the present conflict. For this reason reference will be made particularly to relatively recent articles and the inclusion of older literature will depend only upon pertinent application. Obviously an adequate conception of thoracic anatomy and cardiorespiratory physiology is essential for the proper management of chest wounds. It is considered inopportune and inexpedient to attempt here a detailed consideration of this phase of the subject. It must be realized, however, that a thorough appreciation of these facts is necessary for a comprehension of the derangements produced by injuries and for the institution of appropriate therapy (389).

The principles underlying the treatment of thoracic injury have been succinctly stated by Berry (32–34) and consist in: (1) the treatment of

surgical shock and hemorrhage, if present, by the institution of appropriate measures, and (2) the restoration of the thoracic viscera and of the cardiorespiratory physiology to their normal status as soon as possible. Shock is usually the first and most important consideration in severe chest injuries. According to Butler (77), "A certain degree of shock is desirable" because it is an "attempt on the part of the organism to control hemorrhage . . ." While it is true that under such circumstances shock may be considered a compensatory mechanism, it is highly undesirable for the patient to remain in this condition long. The consequences of prolonged shock are too well known to require further discussion (44, 184, 294). Suffice it to say that one of the first considerations in the management of severe chest injuries is the treatment of shock. As emphasized by Sellors (387, 388) and Blades (43), shock in severe chest wounds differs somewhat in manifestations and in management from that observed in wounds of other parts of the body. In the former the mental condition is unusually active and anxious and because of possible mechanical interference with vital capacity due to hemorrhage or an open pneumothorax, dyspnea and even cyanosis may be prominent manifestations. Painful respiratory movements and coughing may further increase these difficulties and exhaust the patient. For these reasons the first-aid measures must include not only the treatment of primary shock, but also the correction of the factors causing respiratory difficulty. Morphine for the relief of pain, anxiety, and possible restlessness should be administered immediately and preferably intravenously for more prompt results. The application of heat is essential. The administration of oxygen is a valuable adjunct and its effectiveness in the treatment of shock and the relief of dyspnea and cyanosis has been emphasized by a number of observers (355, 356, 387, 388). Placing the patient in a restful posture and inducing comfort are extremely important both as regards combating shock and decreasing respiratory embarrassment. In this respect the posture used in those patients differs from that used in shock from other injuries. Most observers agree that the propped up or sitting position is better than the conventional supine or Trendelenburg position because breathing is easier and the patient is more comfortable (43, 124, 153, 188, 246, 346, 353, 397). Because an associated rib fracture or other chest-wall injury produces excruciating pain, which contributes further to shock, it is desirable to immobilize the chest wall as well as possible. This may be accomplished by adhesive strapping or by a multiple tape binder. In this connection Blades (43) emphasizes the importance of the method used in immobilizing the chest wall and states that the method usually described consisting of placing the adhesive strip over the fractured rib and including slightly more than half the chest is inadequate. He considers partial immobilization of the entire thorax, regardless of the level of the fracture with a single strip of adhesive which encircles the lower costal margin as a much more effective procedure. The administration of fluids to restore the circulating blood volume is also important. Such fluids should preferably consist of blood or plasma. Obviously, in these patients they should be administered judiciously. In addition to these first-aid measures to combat shock, hemostasis especially of the parietes should be effected and an open pneumothorax immediately closed. These will be discussed further in the consideration of such complications. While other therapeutic measures may be necessary in the management of the various manifestations of the different types of chest wounds, these procedures are designed primarily to combat shock and to prepare the patient for transportation or for further therapy. This is particularly applicable to chest wounds occurring at the battlefront where the exigencies and adversities of circumstance do not permit the time-consuming preparation necessary for the complete management of such cases. In timely articles Roberts (355) and Talbot (417) have directed attention to these facts and have summarized these first-aid measures as follows: (1) adequate treatment of shock; (2) administration of morphine to relieve pain; (3) immobilization of the chest wall by strapping if fracture is present; (4) placing the patient in the position of greatest comfort for transportation, and this is probably the propped-up posture; (5) immediate closure of open pneumothorax and relief of intrapleural positive pressure; (6) control of progressive bleeding from the chest wall; and (7) administration of antitetanic serum.

Before discussing further the management of chest wounds it may be desirable to consider briefly the prophylaxis of these injuries. The relative frequency and the undeniable gravity of chest wounds especially in warfare have been clearly demonstrated. Moreover, as Walker (446, 447) has justifiably emphasized, a relatively large number of soldiers in the front line are injured or killed by small fragments of grenade or shell piercing the front of the chest, "splinters that ripped open the heart, or the roots of the great blood vessels, and caused almost instantaneous death." He directs attention to the occasional

miraculous escape from fatal injury because of deflection of these splinters by the presence of such breast-pocket articles as a cigarette case or a New Testament. During the last war an analysis of the wounded reaching the casualty clearing station revealed that slightly over 60 per cent were caused by projectiles other than bullets. Of interest in this connection are the figures given by the Medical Department of the United States Army in the last War (282). In a series of 2,387 chest injuries in which the military agent was specified, 35.2 per cent were due to rifle balls and 65.7 per cent were due to shell and shrapnel. Walker (446) divides the velocity of these various agents into three categories: (1) low velocity (up to 600 ft. per second); (2) medium (up to 1,200 ft. per second); and (3) high (up to 2,800 ft. per second). By the use of appropriate armor it is possible to stop missiles of low and medium velocity. Accordingly, protection would be afforded against shrapnel, hand grenades, revolvers, automatic pistols, and some splinters. For this purpose Walker suggests the use of a jerkin made of laminated steel segments which would permit unrestricted motion and weigh only fourteen pounds. Other lighter material such as compressed fiber or canvas and bakelite may be used. Walker (446, 447) mentions that he has been informed that German shock troops are protected. Obviously such a prophylactic measure warrants serious consideration.

In discussing the management of the different forms of chest injuries and their varied manifestations and complications, a number of classifications have been proposed (8, 35, 43, 47, 48, 66, 109, 124, 126, 178, 190, 200, 255, 290, 355, 367, 418). Generally these are unsatisfactory or inadequate because not infrequently such wounds are complicated by a variety of lesions producing a number of different manifestations. However, for purposes of convenience and expediency the classification given on this page is used:

I. Non-penetrating
  A. Parietes
    1. Soft-parts injury
    2. Skeletal injury
  B. Viscera
    1. Pleuropulmonary lesion
    2. Cardiac and mediastinal injury
    3. Diaphragmatic injury
    4. Commotio thoracis
    5. Traumatic asphyxia
    6. Blast injury
II. Penetrating
  A. Parietes
    1. Laceration
    2. Compound fracture
  B. Viscera
    1. Pleuropulmonary lesion
    2. Cardiac lesion
    3. Lesion of mediastinal structures
    4. Diaphragmatic injury
III. Thoracico-abdominal injury

Of the non-penetrating chest wounds, the simplest forms are those that involve the thoracic wall only and produce no visceral lesions. These are usually the result of some blunt force striking the chest. Because of the greater elasticity of the thoracic cage in children than in older individuals such injuries in the former are less likely to be associated with rib fractures. Those lesions involving only the soft parts of the chest wall, such as contusions, abrasions, and hematoma, are of little or no consequence. Unless some complication such as infection of a hematoma occurs, no special therapy is necessary. On the other hand, non-penetrating chest injuries associated with rib fracture may have serious consequences. The ends of the fragments may penetrate the pleura and lung or produce wounds of the intercostal and internal mammary vessels which result in tension pneumothorax, emphysema, or hemothorax. These complications are of much greater significance than the chest-wall lesion. Rib fracture is not as likely to be associated with these complications in civil practice as in warfare. Because of the relatively protected position of the upper ribs and the greater mobility of the lower ribs, the fracture usually involves the fifth to the ninth ribs. These fractures may not be demonstrable by roentgenography (372) and the diagnosis must depend upon the history, the manifestations of sharp localized pain on respiration, and exquisite tenderness in the injured area. In a series of 124 cases of blunt injuries of the chest, Westermark (459) found that rib fracture was demonstrable by roentgenography in about 45 per cent. Treatment in such simple fractures is seldom operative. Immobilization of the chest wall by adhesive strapping or swathing is usually sufficient. The strapping should be done in overlapping layers from below upward and fixed during full expiration. While some surgeons advocate the application of the adhesive wall beyond the midline anteriorly and posteriorly, others (43) prefer placing the strapping completely around the lower chest wall and believe this method permits greater immobilization. The manipulative method recommended by Teal (421) for reducing rib fractures appears unnecessarily complicated and per-

haps exhausting. In 1933, Latteri (243) suggested alcoholization of the intercostal nerves as a simple and effective method of treating rib fractures. This procedure is based upon the principle of producing immobilization of the region innervated by the alcoholized nerves and, according to Latteri (243), placing the lung at rest. Recently the method has been recommended especially in war wounds by other Italian surgeons (79, 304).[1]

In the more extensive chest-wall injuries several ribs may be fractured at two or more points which results in the so-called "stove-in chest." Such injuries are usually due to direct violence causing a sudden decrease in the anteroposterior diameter of the chest and in civil life are most commonly caused by automobile accidents (43, 352). There is usually an anterior and posterior fracture, the latter occurring at the angle of the ribs. As a result of the fact that the rib fragments between these two fractures are deprived of their support this segment of the chest wall becomes depressed during inspiration and bulges out during expiration. This produces paradoxical respiration which is similar in effect to an open pneumothorax. Immediate careful immobilization of the chest wall is necessary because if this condition is allowed to continue the resultant cardiorespiratory embarrassment may be fatal. It should be realized, of course, that such an injury is not infrequently associated with varying degrees of intrathoracic damage resulting in pneumothorax, hemothorax, and emphysema. After immobilization of the chest wall a careful examination is necessary to determine their presence and extent and appropriate therapy should be instituted.

Fracture of the sternum is not infrequently associated with visceral damage because of the force required to produce this injury. Its occurrence is relatively rare although its presence causes little difficulty in diagnosis because of the deformity due usually to the protuberant lower fragment overriding the upper. Various methods of reduction have been suggested. This may be attained by hyperextension of the neck and chest, which may be accomplished by having the patient lie on a sandbag placed between the shoulder blades. Pressure is then applied to the upper end of the lower fragment. Other simple procedures consist of applying traction to a corkscrew driven into the fragment or hooks attached to the bone margins (352). In some cases open reduction and fixation will be necessary (126). Of particular interest in sternal injuries is the subsequent development of traumatic chŏnēchondrosternon (312). Cases of this nature have been reported by a number of authors (2, 30, 268, 467). A comprehensive review of this subject has been presented by Ochsner and DeBakey (312).

Non-penetrating chest wounds causing visceral lesions are usually associated with some parietal involvement such as severe contusions or fracture of the ribs or sternum. These are usually due to severe compression or crushing injuries. However, in some instances damage to intrathoracic structures occurs in the absence of demonstrable evidence of chest-wall lesions. For this reason the extent of intrathoracic damage cannot be gauged solely by the degree of chest-wall injury. Schwartz and Dreyfus (385) collected 29 cases of laceration of the lung without rib fracture. The possible seriousness of such injuries is demonstrated by the fact that there were 16 deaths in this series. Whereas in most instances these injuries are the result of direct violence caused by blows, falls, automobile accidents, or falling masonry, Berry (34) has directed attention to a "fairly large and interesting group of accidents," which "occur quite spontaneously during fits of crying in infants, paroxysms of coughing or sneezing, sudden straining or wrenching movements with increased intrapulmonary pressure or occasionally without apparent cause." Of interest in this connection is the occasional occurrence of spontaneous pneumothorax and hemopneumothorax. Wilson (463, 464) has presented comprehensive studies of the conditions which may follow trivial or no injury. In warfare these injuries are most frequently caused by falling masonry or débris from shell fire and bomb explosions, and in the last World War they were caused by the caving in of dugouts or trenches, and by airplane accidents. The lesions produced by such injuries as well as those associated with penetrating rib fracture usually involve the pleuropulmonary, cardiac, vascular, and other mediastinal structures, and the diaphragm. Simple contusion of the pleura and lung may result in a pleurisy with or without pleural effusion. If a traumatic pleurisy alone exists, management is relatively simple and consists of keeping the patient at rest and administering symptomatic relief. Other pleuropulmonary lesions consist of rupture, tearing, or laceration by penetrating rib fragments, hemorrhagic consolidation of the lung, massive atelectasis, and rupture of the bronchi. It should be realized that "contrecoup" injury of the opposite lung may exist and the resultant pleuropulmonary lesion may be even

[1]Since this was submitted for publication, Harmon, Baker, and Kornegay (*J. Am. M. Ass.*, 1942, 118:30) have reported their experience in treating uncomplicated fractures of the ribs by infiltration of procaine hydrochloride and eucupine dihydrochloride solutions directly into the site of the fracture. The good results obtained in 32 cases of minor rib fractures and 5 cases of major thoracic injuries by this method of therapy support the advantages claimed by the authors.

more extensive than in the side of contact (115). In this connection it should be realized that, while not frequent, contralateral disturbances such as pleurisy and pleural effusion, bronchitis, pneumonia, and massive collapse may occur in chest injuries (100). The vascular lesions consist of rupture or tearing of the intercostal, internal mammary, or azygos vessels and rarely the larger hilar vessels. Occasionally massive mediastinal hemorrhage is observed (471). Injuries of the aorta are almost invariably fatal. Similarly, wounds of the vena cava are very serious and usually associated with other severe and fatal injuries. Occasionally vena-caval thrombosis occurs as a result of blunt trauma to the chest. An exhaustive consideration of superior vena-caval thrombosis and its occurrence as a rare complication of chest injury has been presented by Ochsner and Dixon (316), who reviewed 120 cases collected from the literature and reported 2 cases, 1 of which was due to non-penetrating trauma and the other to a gunshot injury. Other non-penetrating injuries of the mediastinal structures and of the diaphragm will be considered together with those following penetrating trauma. Injury to the heart in non-penetrating wounds will be discussed later.

The importance of pleuropulmonary injury in the intact thorax is probably insufficiently realized. This fact has been emphasized by Fallon (142), who in a recent publication presents an excellent review of the subject. According to this author, Morgagni (296) recognized and described this type of injury in 1761. Of historical interest in this connection is Handley's (183) recent report in which is described a skeleton discovered in Snodland, Kent, with evidence of an extensive crushing chest injury probably occurring in the fourth century A.D. Exhaustive reviews of this subject were presented by Schwartz and Dreyfus (385) in 1907, and by Fischer (146) five years later. Various attempts have been made to explain the mechanism of injury (114, 170, 339, 401, 402), and some have investigated the problem experimentally (93, 220, 237, 428). No attempt will be made to discuss these in detail. Suffice it to say that in general they are based upon the principle of sudden compression and resultant rupture in the possible presence of other contributing factors. The pathological lesion in the lung varies usually with the degree of trauma. Hemorrhage is probably the most common lesion and may be subpleural in simple contusions or more central and extensive in severer injuries. In some cases it may be massive and involve an entire lobe (375) or even both lungs (115, 244, 363). Ruptures of varying extent and character comprise the grosser lesions. These ruptures may be subpleural or central with an intact visceral pleura, or complete penetrating ruptures. Rarely actual rupture of one of the larger bronchi may occur (33, 84, 222, 227, 235, 281, 300, 396). Massive pulmonary collapse may occur in the severer contusions and crushing injuries of the thorax although it has also been recognized in trivial injuries and as a complication of wounds in other areas (58, 474). In this connection Lockwood (263) has recently directed attention to the occasional occurrence of massive collapse in individuals "wounded by a close-up shell or bomb explosion." Moreover, the collapse occasionally involves the lung on the opposite side of the injury (58, 100, 426). Bradford (58) in a thorough consideration of this subject directed attention to the fact that homolateral massive collapse may occur in cases of slight hemothorax and that "the degree of collapse was quite out of proportion to the size of the hemothorax." For this reason, there may be some difficulty in the interpretation of the physical signs and in determining the presence of the collapse. Of interest in this connection is the occasional case in which multiple small areas of atelectasis occur following trauma (218). Bradford (58) also distinguishes between the type of massive collapse occurring in chest wounds and the form more commonly observed in civil practice following operations. No attempt will be made to discuss this complication further as the pathogenesis, clinical manifestation, and management have been adequately considered in numerous previous publications (92, 164, 278, 299, 306, 386, 424). Suffice it to say that in chest wounds it probably occurs more frequently than is generally realized and the possibility of its presence should be constantly kept in mind. As regards the mechanism of production in these cases Bradford (58) rejects the idea of bronchial spasm or bronchial obstruction and states that it "is more readily explained as a result of the immobility and retraction of the chest wall and diaphragm . . . The mechanism by which this condition of the chest wall is produced is obscure, but possibly it is of reflex nervous origin." (58) On the basis of the pleuropulmonary pathological lesion Cooke (91) gives the following clinical classification: (1) the pneumothorax type in which the lesion is limited to rupture of a small number of alveoli with no evidence of hemoptysis or hemothorax; (2) the parenchymal rupture in which there is an intact pleura and hemorrhagic infiltration of the lung substance; and (3) the combined type in which the visceral pleura is also torn with consequent hemopneumothorax.

The clinical manifestations of these injuries vary with the type and extent of the intrathoracic lesions. In the severer forms shock almost invariably occurs immediately following the injury and is frequently of an alarming character. Cough and hemoptysis are also present and dyspnea may be intense. It may be slight or massive but in those patients who survive the shock it is usually of a degree not sufficient to cause marked displacement of the mediastinal structures unless associated with pneumothorax. The presence of air in the pleural cavity is probably one of the most frequent manifestations and if the visceral pleura is torn in such a way that air escapes from the lung with each inspiration tension pneumothorax results which produces increasing dyspnea. Emphysema may be subcutaneous or mediastinal and also varies with the extent and type of injury. The former is frequently associated with rib fracture and is of no consequence if there is only slight intrathoracic injury. On the other hand, mediastinal emphysema may develop in the absence of rib fracture and be of such extent as to produce intense pressure symptoms requiring immediate intervention. In these cases of emphysema with an intact chest wall the air is believed to reach the mediastinum after rupture of the intrapulmonary bronchioles by traversing the peribronchial spaces (385). Once in the mediastinum it ascends along fascial planes and appears in the neck above the sternum. Roentgenology is of distinct value in the diagnosis of these nonpenetrating pleuropulmonary injuries. Westermark (459) has recently directed attention to the diagnostic value of this procedure and states that in a series of 124 cases studied in this manner 86.7 per cent had roentgenographic lung changes associated with rib fracture and 65.6 per cent had such signs in the absence of fracture.

Other later pleuropulmonary complications of these injuries consist of infection with resultant gangrene, lung abscess, pneumonia, and empyema. A number of observers have described so-called contusion or traumatic pneumonia (114, 325, 330, 347, 371, 410, 441). The relationship of trauma to the development of such chronic lung disease as tuberculosis is an important medicolegal problem (45). While it is conceivable that such lung injuries may result in diminished resistance to tubercle bacilli Sergent (390) observed only 9 cases of tuberculosis in a series of 1,400 lung injuries occurring in warfare. Similarly in an extensive war experience Petit de La Villéon (337) records not a single case.

It is obvious from this discussion of these pleuropulmonary lesions that the immediate management of such conditions must be concerned with first combating shock and second the correction of disturbances in cardiorespiratory physiology resulting from the development of such complications as pneumothorax, hemopneumothorax, hemothorax, and emphysema. Reference has been made to the treatment of shock and further therapeutic considerations will be limited to a discussion of the complicating factors.

As previously stated, pneumothorax is a frequent complication of chest wounds and may occur in any injury in which the pleura is torn. Accordingly, it occurs most commonly in association with rib fracture or in the presence of an intact chest wall as a result of lung parenchymal tears involving the visceral pleura. It may be unilateral or bilateral, although fortunately the former is far more common. Rarely traumatic pneumothorax may be complicated by infection. Head (195) reported 3 cases of spontaneous pyopneumothorax following non-penetrating injury of the chest and stated that this was probably the result of rupture of a focus of infection in the lung. In those cases in which the laceration or rupture of the lung exerts a valvelike action permitting only the ingress of air into the pleural cavity, tension pneumothorax results. In such cases the intrapleural pressure rapidly rises to an extraordinarily high level which results in increasing cyanosis and alarming dyspnea. This condition requires immediate treatment which consists of inserting a needle into the chest and aspirating the air from the pleural cavity. This procedure should not be delayed until a pneumothorax apparatus is available for measuring the intrapleural pressure (43). A sufficient amount of air should be withdrawn to permit comfortable respiratory effort or, if an apparatus is available for measuring intrapleural pressure, until this pressure is zero. Not infrequently the air will continue to accumulate so rapidly that it is necessary to insert a small catheter through an intercostal space and connect its lower end to a water-sealed system. In this manner the air in the pleural cavity is permitted to escape and the intrapleural pressure can be maintained at atmospheric level. When air no longer escapes, which usually occurs within several days, the tube is removed. The relief afforded by this procedure is quite dramatic. In lesser degrees of tension pneumothorax repeated aspiration is usually sufficient. Valvular trocars which permit the egress of air but prevent its ingress have been devised for the treatment of this complication (286). Unless complicated by other intrathoracic lesions, tension pneumothorax rarely requires operative intervention.

Emphysema is another complicating condition of chest wounds and may be subcutaneous or mediastinal, localized or generalized. The subcutaneous type is usually associated with rib fracture or lung tears at the site of pleural adhesions. This form, which is a striking manifestation when generalized, produces no serious consequences unless associated with mediastinal emphysema or more dangerous underlying lesions. Both subcutaneous and mediastinal emphysema may be combined with pneumothorax and in such cases therapy should be directed toward correction of the latter. Mediastinal emphysema may be sufficiently severe to produce serious compression of the structures in this area which results in such alarming manifestations as dysphagia, increasing dyspnea and cyanosis, marked dilatation of the veins in the upper part of the chest and neck, extrapericardial pneumatic tamponade, circulatory failure, and death. First appearing in the jugulum and the base of the neck the crepitant area rapidly extends in the subcutaneous tissues up the neck and down the chest and upper extremities, becoming generalized and occasionally producing a striking bloated appearance. Various forms of therapy have been suggested in this more serious form of mediastinal emphysema. Transverse incisions in the jugulum and base of the neck and the use of cup or suction drainage have been described as well as the production of artificial pneumothorax (90, 112, 161, 345, 408). As emphasized by Stenbuck (408), it would seem more rational to attack the problem at its source. Accordingly, in those cases in which there is a tear or laceration of the pleura aspiration of the pleural cavity or water-sealed drainage should be done. In those cases in which injury to a bronchus is suspected operative intervention with closure of the defect may be considered (43).

Hemothorax is probably one of the most common complications of chest wounds and varies in extent with the severity of the injury (57). In slight contusions the degree of hemorrhage is minimal whereas in the more severe traumas as in crushing injuries it may be massive. The hemorrhage may arise from a number of sources, such as the intercostal, internal mammary, and azygos vessels, as well as the larger intrathoracic vessels, but most commonly it arises from the lung parenchyma (3, 56, 57). Hemorrhage resulting from injury of one of the larger mediastinal or hilar vessels is rapid, massive, and usually fatal. On the other hand, bleeding from lung laceration occurs more slowly and gradually lessens as the lung becomes compressed. This is less likely to occur and bleeding will continue longer in hemorrhage from an intercostal or internal mammary vessel because a greater intrapleural pressure is necessary to compress these structures. Head (196) has directed attention to the two factors, decreased blood volume and increased intrapleural pressure, which supplement each other and result in disturbances of the cardiorespiratory physiology following hemorrhage into the pleural cavity. Accordingly, hemorrhage produces a progressive decrease in the blood volume, in the cardiac output, and in the blood pressure, and causes peripheral circulatory failure with eventual death from oxygen lack. The increased intrapleural pressure produces: "(1) a progressive collapse of the lungs and decrease in vital capacity; (2) an increased resistance in the pulmonary circulation; (3) pressure upon the heart and great veins; (4) interference with the return of blood to the heart; (5) a rise in venous pressure; (6) a decrease in cardiac output; (7) a marked exaggeration of the respiratory variation in blood pressure; (8) eventual death from a practically simultaneous respiratory and circulatory failure." (196) On this basis Head (196) concludes that since "the two conditions supplement each other, the patient's symptoms, both respiratory and circulatory, may be relieved by either increasing the blood volume or decreasing the intrapleural pressure."

An interesting and striking feature of hemothorax is the frequent failure of blood in the pleural cavity to clot, even after it has been aspirated. Various attempts have been made to explain this phenomenon. According to some, a certain degree of clotting occurs in all cases and this is influenced by the rapidity of the bleeding (136, 200). In those cases in which the bleeding is slow and the volume of blood small, clotting is less likely to occur because this interval permits certain influences to modify the blood, i.e., the precipitation of fibrin into layers on the pleural surfaces and the defibrination of the blood by the churning movements of respiration. In the more rapid massive hemorrhage the time interval is insufficient to permit the operation of these factors and clotting is more likely to occur. According to Bradford (56) it has been shown that "the bloody fluid in haemothorax contains no fibrinogen, and hence, that although it resembles blood to the eye, clotting has really taken place, and that it is in reality defibrinated blood." In experimental hemothorax Sandison and Elkin (368) found that clotting occurred in some of the animals while it was absent in others and that it was more likely to be present in hemopneumothorax. In commenting on this Van Allen

(442) emphasized the "powerful anticoagulant property" of the pleura and stated that "blood in the pleural space of patients with traumatic hemothorax may or may not be coagulated, and the explanation is probably that the hemorrhage was rapid in the cases with coagulation and slow in those cases without coagulation."

Apparently considerable controversy still exists regarding the management of traumatic hemothorax. Opinions vary from ultraconservatism to radical exploration. Between these two extremes there is the opinion of those who advocate aspiration followed by air replacement. Much of this diversity of opinion is probably due to comparisons of results of the different forms of therapy without adequate appreciation of certain influential factors. Thus in comparing civil injuries with war wounds, the factor of therapeutic application must be considered because in the latter instance the exigencies and adversities of circumstances differ. Moreover, the factors of infection and other complications play more prominent roles in the latter case. It is obvious after consideration of the various factors concerned that the management of traumatic hemothorax cannot be reduced to a simple formula but must be governed by the presence or absence of certain factors in the individual case. In a recent discussion of this subject Chandler (82) classifies the types of hemothorax into three groups with treatment modified accordingly: (1) simple and noninfected, (2) infected, and (3) complicated by many other factors. In simple limited hemothorax most observers agree that conservative therapy is preferable. If the amount of hemorrhage is small, little or no therapy except for the relief of pain is required. Some believe that even diagnostic aspiration in such cases is undesirable. Even if the extent of hemorrhage is greater some authors contend that conservative therapy is the method of choice and aspiration should be done only to relieve increased pressure manifestations. This is based on the assumption that the source of bleeding in such cases is usually from a lacerated lung and consequently is more likely to be controlled by the tamponade effect of the blood. Warner (453), in 1926, advocated phrenicectomy for the purpose of putting the lung at rest and preventing further hemorrhage. During the last World War, Morelli (295) began "to apply to wounds of the lung the concepts of (his) teacher, Professor Forlanini, formulated for the treatment of phthisis, of lung abscess, of bronchiectasis, and of serious hemoptysis." This method of therapy consisted briefly of aspiration and air replacement of the hemothorax. He (295) contended: "(1) that the wounded lung heals quicker and better if it is immobilized and compressed; (2) that if the immobilization be secured early the great advantage is obtained of preventing or checking hemorrhage; (3) that if a hemothorax already exists, being harmful for many reasons, it ought to be evacuated with the substitution of air; (4) that pneumothorax is the ideal means of compressing the lung." He states that in a series of 40 cases of closed hemothorax all were cured. This method was further supported by the observations of Bastianelli (17, 18), who reported 206 cases of closed chest wounds, 88 of which were treated by pneumothorax and 118 by thoracentesis and pneumothorax with a mortality of 3.4 per cent. Of the 7 deaths, 3 were due to empyema, 1 to pulmonary abscess, and 3 to septicemia. Shattuck and Welles (392), using manometric studies in these cases, showed that existing intrapleural pressures can be maintained by the "simultaneous replacement of fluid withdrawn by oxygen volume for volume." It would appear from the reports in the literature that even during the latter part of the World War and afterward with return of interest to chest injuries in civil life, the method was popular only in the Italian Service and did not gain wide adoption. Colonel Yates (469), who was in charge of the American Medical Unit detailed to the study and treatment of thoracic injuries during the last World War, was an advocate of immediate open operation in the treatment of all but limited degrees of hemothorax and was opposed to Morelli's method. In criticizing the latter method he writes: "Air is a serous membrane irritant and elimination of irritation is a basic principle in the prevention as well as the treatment of pleuritis. Positive intrapleural pressure, high enough to stop hemorrhage by pulmonary compression, compresses the homolateral lung, produces contralateral emphysema, and interferes with pulmonary circulation. Compressed lung means contracted lung which is often difficult or impossible of reinflation. If reinflation occurs, a universal adhesive pleuritis is certain. The exact conditions for minimizing the resistance to the flow of blood through the lung, as established by Cloetta, a reduction of mean pulmonary inflation, are met by diaphragmatic paralysis. Diaphragmatic paralysis lasting four or five days can be established by infiltrating the phrenic nerve trunk with 1 per cent cocaine. If this procedure be coupled with closure of the chest without residual pneumothorax, the best conditions for repair and defense have been provided for both lung and pleura." That Morelli's procedure did not gain wide popularity is shown by Foster's report, in

1939 (149). This investigator sent questionnaires to leading surgeons affiliated with general hospitals in most of the larger cities throughout the United States and Canada requesting information concerning the type of therapy in hemothorax. He obtained data from 52 cities, and among this number aspiration and air injection was considered the method of choice in only 2 cities. Thirteen of the surgeons mentioned operative interference "only for the control of progressive hemorrhage, usually from the internal mammary vessels or for the repair of chest wall defects, most frequently depressed rib fractures." The remainder, 71 per cent, favored the method of so-called "watchful waiting." While it would seem that the expectant mode of care is the most popular especially among those treating civil chest injuries, it has definite objections which have been enumerated by Foster as follows: (1) excessive reabsorption time and resulting long hospitalization; (2) fluid alone acts as a poor compressor of the lung tissue and the gradual hemorrhage may not be controlled until the pleural cavity contains 2 or more liters of blood; (3) hemothorax forms an ideal culture medium for bacterial growth and pathogenic organisms may readily flourish in this closed space; and (4) the danger, infrequent as it is, of the formation of a thickening pleura or deforming intrapleural adhesions from failure of complete absorption of the blood.

With the recent revival of interest in chest wounds due to the present conflict there has developed an increasing and more favorable consideration of the aspiration and air-replacement method of therapy. In fact, a review of recent articles on the subject, especially of British authors, leads one to the conclusion that it is the procedure of choice (8, 32, 33, 73, 82, 110, 124–127, 143, 149, 150, 200, 214, 233, 261, 276, 289, 326, 338, 346, 353, 355, 357, 358, 425, 429, 457). In a consideration of traumatic hemothorax at a recent meeting of the Royal Society, Edwards (125) emphasized the value of this method and listed its "obvious advantages: (1) it removed the blood before clotting occurred; (2) it removed an excellent culture medium for organisms; (3) when the hemorrhage was the result of damage to the vessels of the chest wall and was continuing it could be diagnosed early by radiological examination or physical signs and before the general signs of hemorrhage were present if gas replacement had been carried out early, as the increase in fluid within the pleura was obvious owing to the presence of the air there. Where air replacement had not been carried out bleeding might continue without alteration in the physical or radiological signs, as the lung gradually collapsed beneath the fluid until general signs of internal hemorrhage appeared; (4) it prevented the late results of pleural fibrosis and chest contraction and the occasional occurrence of encysted collections in the pleura." To these may be added the fact that the average duration of hospitalization is reduced by more than 50 per cent (149).

Because of the accompanying shock and frequent loss of large amounts of blood into the pleural cavity transfusion of whole blood or plasma is usually indicated in the management of hemothorax following chest injuries. Autotransfusion has been recommended by a number of authors (68, 77, 137, 149, 150, 196, 248, 454, 466). However, the procedure has definite objections. Unfavorable reactions and even fatalities following its use have been recorded, especially if the period of stagnation is longer than twenty-four hours (225). In a consideration of this subject Kilduffe and DeBakey came to this conclusion, "Whereas in desperate cases or grave emergencies autotransfusion may be considered, its indications are definitely restricted. This is particularly true at present because of the ready availability and effectiveness of plasma and the rapidity, facility, and safety of this form of transfusion."

Although secondary infection of hemothorax is more likely to occur in penetrating chest wounds than in the non-penetrating types, its possible development must be constantly considered. Early diagnosis of infection is essential and one should not wait until the classical manifestations of infection have developed before instituting therapy. For this reason emphasis has been placed upon careful examination of the aspirated fluid (82, 127, 214, 261) and determining the presence of infection by gross appearance, odor, and smear and culture studies. Chandler (82) states that if the aspirated fluid "has any unpleasant odour, it must be assumed to be infected, no matter what the bacteriological report, and treated accordingly without delay." Hoyle (214) emphasizes the value of performing smear studies and states that if organisms are demonstrable "treatment should begin at once." After establishing the presence of infection prompt and appropriate therapy should be instituted. This consists of drainage either by repeated aspiration or by closed intercostal drainage with waterseal. Hoyle (214) believes that in the early stages repeated aspiration is preferable and says, "It is a mistake to insert a drainage tube until the infection has become localized." Edwards and Davies (127), however, recommend closed water-sealed intercostal drainage and irrigation with 1 to 3,300 azochloramide solution. The

use of chemotherapy in the management of such infections will be discussed later.

At present most observers agree that the indications for immediate open operation in the treatment of non-penetrating traumatic hemothorax are limited. Following the last World War, however, there was an increasing sentiment favoring immediate intervention. This is indicated by Yates' (469) statement: "If it be granted that thoracotomy has become a safe operation, then cumulative evidence indicates that immediate open operation is the sane treatment for all but the limited degrees of hemothorax, even if restricted to the removal of the liquid and coagula." In the presence of massive or progressive hemorrhage as might occur in laceration of an internal mammary or intercostal vessel, thoracotomy may be considered. In any event operation should not be done until shock has been overcome. Some consider the presence of large clots as an indication for operation (104, 134). More recently Edwards and Davies (127) have suggested thoracoscopic removal of such clots.

As previously stated, massive collapse may be associated with hemothorax and may be homolateral or contralateral. Once the condition is recognized, every attempt should be made to dislodge possible obstructing clots or plugs of mucus. This may be accomplished by rolling the patient on the uninvolved side and inducing him to cough (369). While in other conditions in which this complication may occur coughing may be an effective means of accomplishing this, in chest wounds this may be difficult or ineffective because of pain, exhaustion, and other disturbance produced by the injury. Postural drainage may be helpful but if these measures are not efficacious, intratracheal aspiration or bronchoscopy should be employed (358).

In addition to pleuropulmonary disturbances in non-perforating chest injuries there may be cardiac involvement. According to reports in the literature such heart injuries occur relatively rarely. In 1935, Bright and Beck (65) presented an extensive review of the literature on this subject and collected 75 cases. They expressed the opinion, however, that although this would indicate its rare occurrence, such a conclusion is not justified because the heart can "tolerate a great amount of trauma," and for this reason probably "the vast majority of non-penetrating wounds of the heart are not recognized clinically." The exceptional cases, that is, those with death from rupture or contusion of the myocardium are reported, whereas the others "in which death does not occur apparently do not receive the correct diagnosis and are not placed in the literature." In 1938 Warburg (449) presented an exhaustive monograph on the subject in which he collected from the literature 202 cases. In a subsequent publication (451) he had brought the total number of reported cases to 261. The condition of non-penetrating cardiac injury is now well established and its pathological and physiological characteristics have been experimentally investigated (25, 65, 229, 238, 239, 297, 381). In the cases analyzed by Bright and Beck (65) the various factors which produced non-penetrating cardiac injuries were classified into five groups: (1) a direct blow over the precordium with penetration of the heart by fragments of rib or sternal fractures; (2) contusion or compression of the heart between the sternum and the vertebræ; (3) indirect violence resulting from sudden compression of the legs and abdomen or "jackknifing" of the body; (4) laceration of the thoracic viscera consequent to falls from great heights; and (5) cardiac concussion which is not satisfactorily defined. The type of cardiac injury which may result from the various forms of trauma obviously depends upon the extent of the traumatic force and the presence or absence of underlying pathological lesions. In general they may be classified into (12, 13, 378, 449–451): (1) rupture of the heart; (2) valvular lesions; (3) pericarditis; (4) disorders of rhythm; (5) angina; and (6) minor cardiac contusions. In the cases analyzed by Bright and Beck (65) rupture of the heart was the most frequent lesion, occurring in 152 of 175 cases. Although injuries resulting in rupture of the heart usually follow trauma of severe violence, cases have been reported in which there was no evidence of external injury (42, 182). The rupture involves the various cardiac chambers with about equal frequency (65). It may occur immediately, because of bursting of the heart by compression or from a sudden rise of intracardiac pressure resulting from the application of direct (145, 332, 333) or indirect forces (224, 373), or it may be delayed for hours, weeks, or months until the area of softening caused by the contusion gives way (173, 213, 321, 348). While in the majority of cases death occurs immediately from cardiac tamponade or extensive involvement of other vital structures, in others the fatal termination occurs at a later date from cardiac insufficiency or aneurysm. Obviously therapeutic consideration in the majority of these cases is precluded by the time factor alone. Of interest, however, is the fact that in the 152 cases analyzed by Bright and Beck (65) there were 30 that presented "opportunities for treatment that were not utilized." This emphasizes the import-

ance of considering the possibility of cardiac injury in those patients who survive the initial trauma. Signs of sudden increased intrapericardial pressure and circulatory embarrassment are indicative of rupture and the need for prompt surgical intervention is urgent.

Valvular lesions of the heart following trauma have been described by several authors (12, 13, 65, 165, 331–333, 361, 378). In 1865, Peacock (332) reported a case of rupture of an aortic valve from strain. In the case described by Barber and Osborn (14) the patient was "blown-up and buried in the débris" at the battle front in the last World War. Fifteen years after the injury the "signs were indistinguishable from those of mitral stenosis of rheumatic origin." He died of pneumonia twenty-two years following the injury and "the stenosis was very obvious and there were features which confirmed beyond doubt the diagnosis of trauma." Traumatic pericarditis with pericardial hemorrhage or fibrinous exudation occurs relatively frequently following blunt chest injuries (13, 166, 350). In his analysis of 261 cases of non-penetrating heart injuries, Warburg (451) found this present in 60 and states that it probably occurred more frequently. The diagnosis depends upon the presence of a pericardial friction rub, the occasional occurrence of characteristic splashing sounds, and the aspiration of serosanguinous pericardial fluid. In the majority of cases the disturbances are transient and the prognosis is good. Occasionally the development of such complications as infection and constricting adhesions may require further appropriate therapy.

Disorders of rhythm following this type of cardiac injury consist of auricular fibrillation, auricular flutter, extrasystoles, and varying degrees of heart block. Warburg (451) found that auricular fibrillation occurred in one-fifth of his collected series. In 10 cases analyzed by this author 2 of the patients recovered completely, 6 continued to have signs of cardiac impairment, and 2 died. The medicolegal significance has been discussed by Hay and Jones (194). Cases of auricular flutter have been reported by Barber (12) and Schleiter (378) but it is apparently infrequent and of transient character. Extrasystoles are also infrequently reported (223). There were only 11 cases in Warburg's (451) collected series. More recently Barber (13) reported another case in which the irregularity persisted a year after the accident. Heart block may be indicative of a deep-seated lesion. Cases have been recorded by a number of observers (86, 436, 445, 451) and in the collected series of Warburg auriculoventricular block occurred in 10 cases and sino-auricular block in 1 case. In some the disturbance is temporary while in others it may persist for years (121). In 1929, Kohn (231) directed attention to the syndrome of traumatic angina pectoris. Since then a number of cases have been reported and Warburg's most recent review included 16 cases. In 1937, Bean (22) reported 3 cases of coronary thrombosis following trauma and the subject has more recently been discussed by Meessen (283). Characteristic electrocardiographic patterns have been described (6, 450, 468) and experimental investigations have confirmed these findings (229, 381). On the basis of his experimental and clinical studies Schlomka (381) concluded that vasospasm of the coronary arteries may be initiated by sharply localized blows to the precordium in an analogous manner to segmental arterial spasm occurring in peripheral injuries. According to the duration of the ischemia, the damage to the coronary vessels and the myocardium may be transient or permanent. Boas (46) who has recently reported a case discussed the medicolegal aspects of this subject.

Minor cardiac contusions following chest trauma have been described by a number of observers (12, 13, 223, 253, 378). Barber (12, 13) records the cases of 7 patients "in whom the heart appears to have been inefficient after a severe blow on the chest." In these cases there were no abnormal signs on examination and the electrocardiogram was normal; the only evidence of myocardial weakness was an inadequate response to effort. Smith and McKeown (400) have recently reported a case of cardiac contusion in which a pericardial friction rub developed twenty hours after the accident and disappeared twelve hours later. Serial electrocardiograms revealed patterns similar to those associated with pericarditis. Because these cardiac disturbances are transient and the patients recover completely the diagnosis is difficult to establish. That complete recovery frequently occurs following considerable trauma to the myocardium has been demonstrated by experimental studies (65, 229, 381). Nevertheless the symptoms and signs of cardiac disturbances developing in a previously healthy individual immediately after a chest injury indicate heart damage.

It is evident from this brief review that varying degrees of cardiac injuries may follow non-penetrating chest wounds. These injuries probably occur more frequently than is generally realized and unless this possibility is kept constantly in mind the diagnosis is likely to be overlooked. This is especially true in minor contusions. Moreover, the diagnosis is frequently difficult to establish and requires considerable caution from the

medicolegal aspect which further emphasizes the necessity of careful clinical observations and laboratory investigations. Except in the immediately fatal cases, once the diagnosis of cardiac contusion has been made the patient's course may follow several possibilities (65): "(1) the symptoms may disappear hours or days after the accident, and the patient may remain well; (2) the symptoms may persist for years, and they may be accentuated by exercise; (3) the heart may fail hours or days after the accident; (4) the contusion may soften, and rupture may take place." According to Bright and Beck (65), in the management of these cases therapeutic measures should be instituted toward combating myocardial failure and cardiac rupture. These consist essentially of "absolute rest and the use of morphine or other sedatives as necessary. The heart should be saved as much as possible. Any exertion should be avoided. Mild laxatives should be given, if necessary, to avoid straining at stool. Digitalis may be indicated for the tachycardiac or auricular fibrillation." In cases in which there is evidence of pericardial effusion aspiration is advised. The diagnosis of rupture demands immediate operative intervention.

Commotio thoracis is a distinct clinical entity which follows severe non-penetrating chest injury with clinical manifestations of serious intrathoracic damage but with no objective evidence of anatomical disturbances (7, 43). During the last World War the condition occurred in soldiers who were near exploding shells but who received no visible evidence of having been struck. In civil life it has followed explosions and "other accidents in which the individual is badly shaken up and but narrowly escapes serious injury" (7). Intense emotional strain has been considered a significant etiological factor. During the last World War, autopsies performed on these cases revealed no explanation of the fatal termination. Clinically the condition is characterized by unconsciousness; cold clammy skin; feeble, slow, and frequently irregular pulse; and slow shallow respiration. While in some cases complete recovery ensues, in others death occurs in spite of all therapy. In the management of these cases therapy is essentially supportive and consists of the application of those measures commonly used in the treatment of shock.

Traumatic asphyxia, which is referred to in Germany as "Druckstauung" and in France as "masque ecchymotic," is another type of nonpenetrating chest injury which may follow sudden brief violent compression of either or both chest and abdomen. Thorough considerations of this subject have been presented by Heuer (205) who collected 127 cases, in 1923, by Laird and Borman (240) who reviewed 16 additional cases, in 1930, and recently by Bonnin (53). The condition occurs most commonly following the application of a direct compressing force such as the crushing weight of heavy objects, but not infrequently it follows diving accidents or so-called "jackknife" injuries in which the individual is forcibly "doubled-up" so that the thighs and knees are brought in contact with the chest and upper abdomen. This unique condition is characterized by a deep violet blue or bluish black discoloration of the face, neck, and occasionally the upper part of the chest, the shoulders, and upper arms associated with swelling and edema of the tissues in this area, and particularly in the lids and lips. Careful examination of the cutaneous discoloration reveals numerous minute ecchymotic or petechial hemorrhagic spots which may also involve the buccal and pharyngeal mucosæ and the auditory meatus. Not infrequently the discoloration is absent in areas corresponding to points of pressure on the underlying skin from collar bands, suspenders, and creases of clothing. Gradual fading of the discoloration begins from the second to the fourth day after the onset and has usually disappeared completely within two weeks. No characteristic chromatic changes are observed with this fading process, a fact which had led to the belief that the discoloration is due not to extravasation of blood into the tissues but rather to extensive venous stasis. This belief is further supported by microscopic examination of the discolored skin and subcutaneous tissue. Subconjunctival hemorrhages are usually present and occasionally retrobulbar hemorrhages associated with exophthalmos have been observed. Unconsciousness, occurring in about a third of the cases, is usually of short duration. Ocular and visual disturbances have also been observed. In a thorough investigation of this manifestation Heuer (205) found that there were 16 cases reported in the literature including his own in which immediate subjective visual disturbances were present. While in about a third of these cases these manifestations were transient, in others there was permanent blindness and progressive optic atrophy. The explanation for loss or impairment of vision in some cases is the presence of retinal hemorrhage, while in others it is probably "degenerative changes in the retina, the result of vascular stasis with oedema." (205) Various theories have been proposed to explain the striking manifestations of this condition and these have been briefly summarized by Heuer (205), but apparently none

is entirely satisfactory. Hueter (215) originally proposed the mechanical theory and considered the discoloration due to vasomotor paralysis and back pressure in the dilated veins. Subsequently Perthes (336) directed attention to the absence of functioning valves in the veins of the discolored area. Accordingly, Perthes believed that this explained the limitation of the discoloration which he thought was due to extravasation of blood following rupture of the peripheral venous capillaries consequent to the sudden increased pressure and reversal of flow. This theory is discredited by the histological demonstration of absence of hemorrhage into the tissue (21). In his recent consideration of the etiology, Bonnin is inclined to the theory of a wave of back pressure in the veins and states that apparently back pressure dilates the vessels, and that the anoxemia, which continues for the length of time the thorax is compressed, contributes to the paresis of the vessel walls, which become overdistended and so lose their tone. He comes to the conclusion that "a slow squeeze produces cyanosis, a rapid squeeze is likely to produce petechiæ, and the combined type of injury produces cyanosis together with petechiæ."

Associated lesions such as fractures of ribs and other bones and occasionally intra-abdominal injuries have been observed. Necropsy studies have been made by a number of investigators and these have been summarized by Heuer (205). Cerebral congestion has been the most significant finding in the brain (52, 60–64, 359). Examination of the skin and subcutaneous tissue revealed overdistended capillaries but rarely any blood in the tissues outside of these vessels (21, 52, 60–64, 359, 465). Intrathoracic lesions consisted of hemothorax, subpleural and pericardial hemorrhages, laceration or rupture of the lung, congestion and hemorrhagic consolidation of the lung, and bronchopneumonia (52, 60–64, 202, 242, 287, 305, 318, 320, 359). Abdominal lesions include hemoperitoneum; laceration of the liver, spleen, kidney, and diaphragm; perforation of the duodenum and bladder; and hemorrhagic infiltration and congestion of the viscera (52, 60–64, 205, 242, 287). In the absence of these severe associated injuries traumatic asphyxia in itself is apparently not serious and requires no specific therapy. The majority of the patients recover completely. Among the 127 cases collected by Heuer (205), 27 patients (21.2 per cent) died immediately after the injury and 8 (6.3 per cent) of subsequent complications.

Another type of non-penetrating chest wound which is assuming increasing significance in the current European conflict is the so-called "blast injury" to the lungs. This is a form of chest injury which occurs in individuals exposed to the detonation of a high explosive such as a bomb, which produces characteristic clinical manifestations and pathological lesions in the lungs. While during the last World War the condition was not specifically recognized, reference was made to the finding of dead soldiers in the field after explosions without serious external injury but not infrequently with blood-stained fluid in the mouth and nose (263, 266). Referring to 250 cases of chest wounds occurring during that war Thomson (426) states that there were "24 cases of non-penetrating wounds or cases in which penetration was doubtful," and in which "injury involved either the lungs or pleura as shown by haemoptysis, pleurisy or pulmonary collapse." In commenting upon these cases Zuckerman (472) states that, "the blood-stained fluid which is found in the mouth and nose in cases of this kind is due to traumatic haemorrhage in the lungs." Similar forms of chest injuries were observed in the recent Spanish War (179, 234, 395). Probably as a result of ruthless and indiscriminate bombing in the present great conflict this type of injury is apparently assuming serious proportions and receiving significant consideration (105, 123, 141, 174–176, 233, 234, 322, 355–358, 364, 365, 415, 461, 472, 473).[1] The most extensive inquiry into this subject has recently been reported by Zuckerman (472, 473).

In discussing the physics of blast Sutherland (415) and Zuckerman (472, 473) direct attention to the similarity between a blast wave and an excessively intense sound wave. Zuckerman (473) states that in the detonation of a bomb, "the solid explosive is converted into gases which are confined in the casing at a pressure that has been variously estimated as between 100 and 650 tons per sq. in. As a result of this pressure, the casing is blown to pieces, and the gases escape, and by their expansion produce a blast wave in the surrounding air. The blast wave is a single pulse of increased pressure followed by a phase of suction, and in general form is similar to a single pulse of a large amplitude sound wave." The movement of this wave is extremely rapid and its total duration very brief. The blast wave has two components: a pressure component and a suction component. Obviously the latter is considerably weaker than the former because the suction component can never be "greater than 15 pounds per sq. in., since this corresponds to a perfect vacuum." (473) Several factors influence the magnitudes of

[1] A recent comprehensive review of this subject was presented by King and Curtis (*Surg., Gynec. & Obst.*, 1942, 74:53).

these components of a blast wave. Obviously larger amounts of explosive increase the magnitude. Moreover the pressue is higher closer to the explosion and rapidly decreases with distance from the source. This may be demonstrated by the hydrostatic pressure produced by the explosion of a 70 lb. charge; at 14 ft. it is 110 lb.; at 18 ft. 60 lb.; at 30 ft. 15 lb.; and at 50 ft. 6 lb. In considering the effect of blast Zuckerman (473) states that all objects "in the immediate neighborhood of an explosion . . . first experience a violent increased pressure, which may tear them to pieces and blow them far from the scene of the explosion, or affect them directly without doing either of these things. Whether or not an object is shattered by, and blown in the direction of, the pressure wave, it may later be pulled towards the centre of the explosion by the backward movement of air associated with the weaker suction wave, because of the longer time for which this acts."

A number of clinical and experimental investigations on the physiological and pathological effects of explosion blasts have been performed. Toward the end of the last World War some experimental observations on the effects of blast were made by Marinesco (274), Mairet and Durante (272), and Hooker (212). These investigators found that the most striking lesions were hemorrhagic and occurred in the lungs, central nervous system, and less frequently in the intra-abdominal viscera. The most thorough studies, however, have been recently reported by Zuckerman (472, 473). This author exposed various experimental animals such as mice, rats, guinea pigs, rabbits, and monkeys, to explosions at varying distances from the charge. It was found that at certain distances the animals were immediately killed while further away there was a zone of pressure in which animals survived for periods varying between a minute and a day (473). These animals sometimes had blood-stained froth in the upper respiratory passages and afterward suffered from air-hunger, dyspnea, and tachypnea (473). However, some of the animals in which these manifestations appeared survived the twenty-four hour period and recovered completely. None of the animals exhibited external evidence of injury. Necropsy studies on these animals showed that the most prominent lesion was bilateral hemorrhage in both lungs varying in degree according to the distance of the animals from the charge. Similar lesions were occasionally observed in the intra-abdominal organs. The hemorrhagic lesions varied from pin-point spots on the lung surface to patches which in the very severe cases involved the entire lung surface. Of particular interest was the fact that these hemorrhagic lesions frequently followed the rib lines. On section the lungs showed "confluent zones of hemorrhage" which in the less severe cases were scattered and sometimes related to large bronchi, but in the very severe cases the lungs appeared "hepatized." Blood was found in the nasopharynx, trachea, and bronchi in all animals that died of the blast injury. Of particular interest also were the anatomical sites of election of these lesions. It was found that the anterior borders of the lungs "between the front of the chest wall and the mediastinum, and the inferior borders, which become compressed in the costo-phrenic sinus" were most vulnerable. The mediastinal surface and particularly the azygos lobe were other frequent sites. Microscopic studies of these hemorrhagic lesions showed blood filling the alveoli and small bronchioles with disruption of the alveolar walls and capillaries as well as interstitial hemorrhage. Fat embolism which was reported by Robb-Smith (354) in 1 case was not observed in any of the animals in Zuckerman's experiments and not mentioned in the clinical post-mortem studies of others (141, 176, 177, 324).

In considering the factors responsible for these pulmonary hemorrhagic lesions Zuckerman (473) states that several hypotheses have been proposed. The first is "that the lesions are due to the lowering of alveolar pressure by the suction wave, acting through the respiratory passages, with the consequent rupture of the alveolar capillaries." Another is "that the lesions are caused by the 'sudden distention of the lungs with air' rather than by 'external pressure on the ribs'"; and the third possibility, advocated by Hooker (212), is "that the lung lesions are due to the impact of the pressure on the chest wall." That this last possibility is probably the correct one was demonstrated by the results of Zuckerman's experiments. He found that the animals "exposed to blast from the explosion of charges of hydrogen and oxygen in balloons showed that lesions are bilateral when the animals are placed some distance from the explosion, and mainly, if not entirely, unilateral when the animals are placed so close that one side shields the other . . . " and that "the lesions are on the side facing the explosion." He states further, "This fact (as well as the anatomical sites of election of the hemorrhages) suggested that the lesions are caused by the impact of the wave on the body wall. It could hardly be interpreted in any other way. For if blast affects the lung through the respiratory passages, either by reducing alveolar pressure or

by suddenly distending the alveoli with air, it is impossible to explain why animals placed close to the balloon explosion sustain damage to the lung only, and to the lung on the side facing the explosion." Further confirmation of this hypothesis was obtained by experiments in which rabbits that were thickly clothed in sponge rubber jackets received no pulmonary damage, or very slight damage when compared to the controls; and animals with only one side of the trunk clothed in this way suffered severe damage on the uncovered side when the explosion faced that side and no damage when the explosion faced the covered side.

In considering the practical significance of these experimental observations on blast as a factor in bombing and air-raid casualties Zuckerman (473) directs attention to the fact that "the circumstances . . . are very unlike the experimental conditions that have been described." For this reason a number of other factors may play significant roles in the production of these casualties and in their casualty survey it was found possible to classify the causes of injury into four groups:

I. "(a) Being hit by splinters; (b) being affected by the impact of the blast wave (e.g. effects on the lungs and ears); (c) being burnt by the flame of the explosion; (d) (possibly) being poisoned by carbon monoxide liberated by the explosion in enclosed spaces; and (e) (possibly) in the remote chance, being hit by the bomb itself.

II. "(a) Being thrown by the blast wave against a hard surface; (b) being bowled over as a result of a splinter wound.

III. "(a) Being hit by secondary missiles, e.g., flying masonry, wood, furniture, glass, girders; (b) having walls, floors, ceilings fall on one, either as an immediate effect of an explosion or as a result of collapse due to an earth shock wave; burial under débris; in steel shelters, being crushed by the caving-in of the shelter; (c) falling, through being knocked, other than directly by blast, from a raised position, or through collapse of a floor; and (d) (possibly) the impact of an underground wall violently accelerated, but not broken by an earth shock wave.

IV. "(a) Asphyxiation; (b) carbon monoxide poisoning; (c) burns; and (d) drowning."

After considering these various factors it is reasonable to assume that blast injuries incurred under circumstances similar to those of the experiments will be relatively infrequent. However, various degrees of injuries and even fatalities following blast have been reported. Falla (141) reported a case in which the patient was injured by a bomb exploding in the workshop about 45 ft. away and died twelve hours later. At necropsy characteristic hemorrhagic lesions were found in the lungs. A somewhat similar case was described by Osborn (324). An analysis of 27 cases was recently presented by Dean, Thomas, and Allison (105). Severe blast was experienced in all but 2 patients. The significance of the factors described, other than the blast, is demonstrated by this series, for extensive superficial burns were present in 21, fractures in 5, and multiple splinter wounds in 1, and 3 patients were immersed in the sea. Symptoms referable to the chest were present in only 6 patients and these consisted of cough and expectoration, which appeared between the second and fifth days. The abnormal physical signs in the chest, present in 16 of the patients, consisted briefly of decreased diaphragmatic movement; a "ballooned" appearance or fullness of the chest, especially of the lower part, suggesting an emphysema; and impaired resonance. Roentgenographic examination showed abnormalities in 14 of the cases and in most of these the changes were similar to "an early pleurisy—a diminution of rib-expansion on the affected side, together with slight loss of translucency" (105).

The influence of the other factors enumerated in blast injuries is further demonstrated in the report of Hadfield and his coworkers (177). These investigators studied 10 cases in which circumstantial evidence pointed to death being due to "blast." In all but 1 case gross traumatic lesions were completely absent or the lesions were of trivial degree. All of the cases showed some degree of intrapulmonary capillary hemorrhage. Two patients who were extricated from overlying débris were first considered suffering from "blast" injury but subsequent examination revealed that death was due to compression asphyxia. The hemorrhagic lesions in these patients were relatively slight. In 3 cases the blood was found to be saturated with a fatal degree of carbon monoxide. Pulmonary hemorrhages were present in these cases also but there was a "fresh pink colour of the hypostasis." The remaining patients presumably "died from the effects of 'blast,'" and exhibited "free capillary bleeding over large areas in which the respiratory bronchioles, atria, and alveoli showed uniform and considerable overdistention."

It is obvious from the foregoing discussion that there are a number of significant factors in the cause of death of patients who have been exposed to the detonation of high explosives. This is emphasized by Zuckerman (473) who states, "fatal casualties with little or no external signs

of injury will probably only in rare instances have died from the direct effects of blast alone. Other causes of death in such circumstances are asphyxia following burial under débris, carbon monoxide poisoning, and death from chronic diseases aggravated by sudden shock. Whether blast alone can cause death as a result of nervous crisis is a matter which at present is only open to speculation." Moreover, it should be realized that "bruising of the lungs may occur not only as a result of the direct action of blast, but also as a result of secondary and tertiary blast effects such as violent displacement, and the impact of flying and falling masonry."

Although characteristic pulmonary lesions were demonstrable both in the experimental animals and in patients who died immediately or shortly following the blast of explosions, no satisfactory explanation of the cause of death was always determinable. Zuckerman states, "pulmonary lesions cannot always be regarded as responsible." In this connection Hadfield (175) emphasizes the significance of the observation based upon 30 post-mortem studies, that there existed a "disproportion between the amount of blood in the alveoli and the relatively slight damage to the alveolar walls themselves." There was also observed a marked dilatation and congestion of the alveolar capillaries as well as of the alveolar ducts and bronchioles. However, according to Hadfield this may indicate that possibly much of the intrapulmonary capillary bleeding is due to diapedesis and that hemorrhage may continue for a considerable period of time following the accident. Accordingly the variations in degree of intrapulmonary hemorrhage may be explained by the period of survival. In 1 case reported by Hadfield and Christie (176) the bleeding continued for fifty-one hours. According to Hadfield (175) this observation is of therapeutic significance for it means that these patients should be immobilized as if they had had a recent large hemoptysis, and it may be that disregard of this precaution may explain why some, who have been exposed to detonation and have apparently recovered from the initial respiratory embarrassment, have subsequently had a relapse. A pneumonic process subsequently developing in some of the cases was also observed by Hadfield (175) and O'Reilly (322).

It may be readily observed that in the therapeutic management of these cases one is immediately confronted with a number of difficulties. Shock is almost invariably present and in addition to the pulmonary disturbances there are frequently other associated injuries, such as extensive burns, fractures, carbon-monoxide poisoning, and injuries to the intra-abdominal viscera and central nervous system. Because of the intrapulmonary hemorrhages and the possibility of furthering this bleeding by the usual procedures of resuscitation, great care must be exercised in applying these therapeutic measures. The significance of this lies in the fact that the accompanying shock may be attributed to other injuries since the clinical manifestations of pulmonary damage in blast injuries are frequently delayed for several days. For this reason blast injury of the lungs should always be suspected in such cases and the patient treated accordingly. It is probably desirable not to employ the Schafer method of artificial respiration for asphyxia in these patients (122). It has been suggested that morphine should be used cautiously and in small doses (⅛ gr.) to allay restlessness (123). On the other hand, Whitty (461) takes exception to this because "it is not a sound principle of therapy to deny the full use of a unique and advantageous drug unless its incidental deleterious effects cannot be avoided or controlled." Since this is possible by the administration of "oxygen, carbon dioxide and other respiratory stimulants" one is inclined to agree with Whitty (461) that the use of full doses of morphine to relieve pain and restlessness is rational. In view of the experimental and clinical observations on the lung changes these patients "should be rested as strictly as if they had had recent severe haemoptysis" (176); and the inestimable value of morphine for this purpose has long been recognized. The importance of absolute rest in these patients is further illustrated by the case reported by Hadfield and Christie (176). This patient had shown considerable improvement thirty-six hours after the accident and was considered fit for transportation. However, the movement consequent to the journey by ambulance caused the patient's condition to become considerably worse. Transfusions of whole blood, plasma, or other fluids may be better withheld in the early stages because of the risk of inducing pulmonary edema, and shock should be combated by the institution of other methods which stimulate the peripheral circulation (123, 364). Because of the acute pulmonary congestion Hadfield and Christie (176) consider venesection and the use of concentrated serum as possible procedures. Posture is also considered important and the best position is probably with the shoulders raised (123). In those cases with evidence of unilateral contusion the patient should be placed so that he lies on the contused side to prevent aspiration into the normal lung. If it

becomes necessary to employ a procedure in which an anesthetic is required, a local or intravenous type is preferable (123, 356, 364). The treatment of the lung injury is "mostly symptomatic and not unlike that of pneumonia—the administration of morphine and heat for pain, of expectorant mixtures for cough, of oxygen for cyanosis, and the usual general nursing care. Sulphapyridine may be useful in preventing infection of the damaged areas" (364). Obviously associated injuries such as fractures, extensive burns, and carbon-monoxide poisoning will require appropriate therapy but the pulmonary lesion must be kept in mind and methods employed which will not aggravate this condition.

As previously stated penetrating wounds of the chest are far more frequent than the non-penetrating types. This is true particularly of injuries inflicted during warfare. Moreover this type of chest wound, in general, is far more serious than the non-penetrating variety. This is due to the fact that the former is more likely to be complicated by greater disturbance in the cardio-respiratory physiology, by extensive tissue damage, by retention of a foreign body, and by consequent infection. For this reason operative intervention is more frequently indicated. However, because shock is almost invariably present, and this is true especially in war wounds, even urgent operation must be delayed. Except in cases of open pneumothorax and hemorrhage from a parietal wound, operative therapeutic procedures should not be instituted until the patient has recovered from shock. The management of shock in these conditions has been considered.

While it is convenient to classify penetrating wounds of the chest into those that are limited to the chest wall and those that involve the pleura and intrathoracic structures, not infrequently this distinction is difficult to make. For this reason considerable care in the examination and observation of the patients must be exercised. Although during the period of shock this examination must be limited and the patient allowed to rest as much as possible, he should be watched closely to determine any evidence of deterioration in his general condition that would indicate continuous intrathoracic hemorrhage or serious visceral damage. A careful clinical history is essential in ascertaining the extent of the injury. Various agents such as knife blades, ice picks, rifle bullets, bomb splinters, shrapnel, and shell fragments produce characteristic lesions with varying degrees of tissue damage. The site of entrance and exit, and knowledge of the direction of the inflicting agent facilitate determination of the organs injured and the possible extent of tissue damage. In this connection it should be realized that for various purposes, such as the avoidance of military service, penetrating chest wounds may be self-inflicted and simulated (17). In addition to the clinical history, a careful physical examination should be made with particular attention to signs indicating the presence of air or fluid in the pleural cavity, and frequent determinations of the temperature, pulse rate, blood pressure, and the apex beat of the heart are essential. As soon as the patient's condition permits, roentgenographic studies should be performed. The value of such studies in determining the presence and location of retained foreign bodies, and in confirming mediastinal displacement, pneumothorax, hemothorax, intrapericardial tamponade, and contralateral collapse of the lung has been repeatedly emphasized. Such studies should be made in the erect posture.

Penetrating wounds of the chest wall which do not involve the pleural cavity are usually of no serious consequences. However, because of the possibility that the pleura may be perforated they should be carefully explored. In general, such wounds are produced by spent missiles, tangential impact of various projectiles, and occasionally by a blunt crushing force. They may consist of simple punctures or incised wounds or may be complicated by considerable laceration of muscle tissue and by fractures of the ribs, sternum, clavicle, or scapula. Occasionally they are produced by bullets which are deflected along a rib. In general the management of these wounds is similar to those in other parts of the body. This consists essentially in thorough cleansing, excision of devitalized tissue, and primary repair if therapy can be instituted in the first six or eight hours, i.e., before infection has developed. Every attempt should be made to avoid opening of the pleura and to protect it from infection. Wounds in the back of the chest are more likely to be associated with greater tissue damage than wounds of the anterior part of the chest. This is due to the greater musculature of this area and the presence of fascial planes which permit extension of blood and infection. For this reason considerable care must be exercised in the excision of lacerated and devitalized muscle tissue in these regions and the prevention of deeply placed anerobic infection (15, 73). In the presence of compound fractures, wide excision of damaged tissue and removal of loose fragments of ribs may be necessary. Damaged intercostal vessels which are usually associated with rib fracture should be carefully ligated. Sometimes these vessels are damaged between the

bodies of the vertebræ and the angle of the ribs where they are not so intimately associated with the ribs. In such instances hemorrhage may occur from these vessels in the absence of rib fracture. For this reason, thoracotomy occasionally is necessary in controlling hemorrhage from these vessels as well as in controlling hemorrhage from the internal mammary vessels. Fatal hemorrhage from an intercostal vessel has been reported (101). Compound fractures of ribs are usually associated with pleural penetration and for this reason thoracotomy in such cases becomes necessary to determine the possibility of lung injury by an indriven rib fragment.

Wounds, especially those occurring in warfare, which involve only the thoracic parietes comprise about 10 per cent of chest injuries according to Yates (469). In another 10 per cent, visceral injuries are produced without penetration of the chest wall. Visceral injury associated with penetrating wounds comprise the remaining 80 per cent. Accordingly, penetrating wounds of the chest are most frequently complicated by intrathoracic injury. Such penetrating wounds may be of the so-called "closed" types or open forms. The former type is produced by an ice pick, knife blade, or bullet. The wounds are usually characterized by a small opening which is readily closed or sealed by the surrounding soft tissue. While the wound in the chest wall may require little attention, the intrathoracic injury may be quite serious. In the management of these wounds attention must be directed toward the complications which may be produced by injury to the lungs, heart, large vessels, and other structures in the mediastinum. The complications produced by such injuries consist of emphysema, pneumothorax, hemorrhage, hemothorax and hemopneumothorax, and intrapericardial tamponade. In addition to these complications there may be lacerated lung tissue, retained foreign bodies, and consequent infection.

Although such complications may also be associated with so-called open chest wounds their management differs from that required in the "closed" type of wound in that the wound of the chest wall requires immediate attention. Such wounds may be of the "valvular" type or may be of the open pneumothorax form. In the former the entrance of air is permitted during inspiration but its escape is prevented during expiration. This leads to the rapid development of tension pneumothorax and requires immediate attention. In the open pneumothorax type the defect in the chest wall is of sufficient size to permit the entrance of air and blood into the pleural cavity during inspiration and their escape during expiration. This causes rapid collapse of the homolateral lung and because of the mediastinal flutter, collapse of the contralateral lung, which results in a marked decrease of vital capacity. Of interest in this connection is a case of open pneumothorax reported by Kroemer (236) in which there was herniation of the lung with blockage of the wound, a condition usually denied. The striking train of symptoms which follows open pneumothorax is too well known to require detailed description. Suffice it to say that the marked dyspnea and rapid, often irregular, labored breathing, cyanosis, coldness, irregular feeble pulse, decreasing blood pressure, and other signs of shock associated with a sucking wound form an alarming clinical picture, and death appears imminent. Obviously treatment is urgent and this consists simply in the immediate closure of the wound. In this connection it is an interesting fact, familiar to all thoracic surgeons, that an open pneumothorax under certain conditions such as in surgical thoracotomy is not dangerous in man. Yet in these traumatic injuries serious manifestations occur. According to Barrett (15) this is explained by "the fact that in man, during quiet respiration, an open pneumothorax does not embarrass the circulation or the respiration beyond the points of their reserve. If the burden of shock, painful respiration, haemorrhage, bronchial obstruction (by blood or secretions), or sepsis is added to an open pneumothorax the load is too great and the result is immediately serious." The gravity of these wounds is demonstrated by the fact that in a series of 18 cases observed by Lilienthal (258) during the last World War there was a mortality of 34 per cent, "a larger death rate than in any other class of thoracic wounds." Various methods have been suggested for the emergency closure of such wounds, consisting essentially of either suture or tamponade (241). The insertion of sponges and fixed dressings is condemned by Achutin (1). Ideally such wounds should be closed by thorough cleansing, removal of foreign bodies and débris, wide excision of devitalized tissue, and primary suture. However, primary surgical closure should not be attempted except in the first few hours after the injury. This is frequently not possible during this early period, and yet immediate closure is urgent. Barrett (15) states that the "best way to close an open pneumothorax in an emergency is to cover the wound with a pad and it is convenient to carry a standard dressing for this purpose; it consists of a piece of mackintosh tissue to one side of which several layers of vaseline gauze have been sewn. This dressing should be

strapped over the wound." A somewhat similar method is advocated by Frey (153) who states that in the German army a water-proofed dressing is placed in the pocket of every ambulance man. Similarly in the Spanish War, Kretzschmar (233) states that a provisional dressing of air-tight oiled silk and elastoplast was provided. Hailes (178) emphasizes the importance of suturing the dressing of multi-layered gauze to the wound edges as the only means of adequately keeping the dressing in place during stretcher transport. During the last World War, the Italian surgeons (17, 18, 295) advocated the use of a dumbbell-shaped rubber bag which after insertion into the wound was inflated, and thus effected hermetic closure. Tiegel (427) has devised a valve drainage plate which may be applied to the wound, thus permitting immediate closure as well as drainage to prevent the development of hemothorax and tension pneumothorax. Subcutaneous pneumopexy or suture of the lung to the wound edges as recommended by some (90, 128) is condemned by Frey (153).

Those cases of open pneumothorax in which emergency closure has been effected by sterile air-tight dressings, if seen early enough after injury, can still be treated by primary suture. In this connection Barrett (15) emphasizes certain features concerning the suture of these wounds which are particularly important from the military aspect. He states that while in general the suture "can include both muscles and skin after efficient and early excision," this procedure "does not apply to patients who have to be evacuated soon after operation, with the possibility of a journey of several days without careful supervision." For this reason, "it is wise to sew the muscles over the defect but not the skin, and to cover the wound with a pad and strapping. Delayed primary suture can then be done at the base hospital." Following primary suture, according to Barrett (15), intercostal closed water-sealed drainage of the pleural cavity for at least forty-eight hours is essential. If at the end of this time microscopic examination of the fluid reveals no micro-organisms the drainage tube may be removed. On the other hand, if organisms are present drainage must be maintained. However, the advantage of this procedure lies in the fact that the original wound is allowed to heal while an empyema may be developing. Not infrequently these patients are obtained at a stage when primary suture is contraindicated. This is due to the fact that after about eight hours, infection is already established or very likely to develop. However, as emphasized by Barrett (15), in such an instance "the wound must be left surgically open, so that pus and exudate can escape, but closed with an air-tight dressing." He directs attention to the danger of sewing the muscles or the skin over the defect because "it engenders sepsis in the chest wall as well as in the pleura." In such cases intercostal drainage is necessary and after "the patient has overcome the superficial infection the sucking wound should be treated by secondary suture, an operation which can be undertaken in the presence of a properly drained empyema."

In the "valvular" type of chest wound immediate closure is also indicated, and the tension pneumothorax which may be present after closure in this type, as well as in the open pneumothorax type, should be managed as previously described. If water-sealed drainage is done in the latter type, as is usually advocated, tension pneumothorax will be obviated.

As previously emphasized in both the so-called closed penetrating chest wounds as well as in the open wounds the injury to the chest wall is in the great majority of cases accompanied by varying degrees of injury to the intrathoracic structures. Accordingly, in any type of penetrating chest injury it is important to determine the presence of pleuropulmonary lesions, cardiac lesions, and injuries to the hilar vessels and mediastinal structures, as well as to the diaphragm and subphrenic structures. According to the structures involved and the extent of damage produced, the resultant manifestations will be reflected by the occurrence of certain complications such as emphysema, tension pneumothorax, hemorrhage with consequent hemothorax, hemopneumothorax, intrapericardial tamponade, and later infection. As has been previously emphasized the presence of these complications causes marked disturbances in cardiorespiratory physiology. Moreover, it is this factor which makes the difference in the management of chest wounds as compared to wounds in other parts of the body. Accordingly, in the management of penetrating chest wounds, as in the non-penetrating type, therapeutic considerations must be focused on the management of these complications.

In general the management of these chest wounds and their different complications can be divided into conservative and radical therapy. The indications of each depend upon a number of factors. Thus penetrating chest wounds occurring in civil practice are in general more readily adaptable to conservative management because they are most commonly of the stab wound or "closed" penetrating type in which extensive tissue injury, disturbances in cardiorespiratory physiology, and development of infection are

minimal. On the other hand, operative intervention is more frequently necessary in war wounds of the chest because they are produced most commonly by such agents which cause extensive tissue damage with greater hemorrhage, disturbances in the cardiorespiratory physiology with the likelihood of a retained foreign body, and infection.

Subcutaneous emphysema and pneumothorax are frequent complications of penetrating chest wounds. In Elkin's (130) series of 553 civil cases the former occurred in 40 per cent and the latter in 24 per cent. The corresponding incidences in Boland's (50) series of 1,009 cases were 15 per cent and 19 per cent. Conners and Stenbuck (90, 408) in an analysis of 68 cases observed subcutaneous emphysema in 40 per cent. Fortunately, however, in the majority of cases, unless associated with serious injury, they are of no grave consequences. Mediastinal emphysema if severe may produce alarming manifestations. Its treatment is similar to that described in connection with non-penetrating injuries. Similarly, tension pneumothorax should be managed as previously considered. If associated with valvular wounds this should be promptly closed and tension relieved by aspiration of air from the pleural cavity. Occasionally air continues to enter the pleural cavity and water-sealed drainage may be necessary. In bilateral tension pneumothorax aspiration of both pleural cavities is required.

Hemothorax is one of the most frequent complications of penetrating chest wounds. Although hemothorax may be due to hemorrhage from a number of sources, the injured lung is probably the most common (56, 59). Of interest in this connection is a case of gunshot wound of the chest in a patient with artificial pneumothorax and complete collapse of the lung which existed prior to the injury (326). It was found that the "bullet traversed only the chest wall and the pneumothorax cavity, there being no significant injuries other than the rib fractures" (326). Hemothorax was present in 37 per cent of Elkin's (130) series, in 25 per cent of Boland's (50, 51) series, and in 36.7 per cent of Steinke's (407) series. It should be remembered, however, that these are civil wounds and that the incidence in war wounds is probably much greater (59, 367). During the last World War in a series of 115 cases admitted to one of the Evacuation Hospitals of the American Expeditionary Forces pure hemothorax occurred in 94 (81 per cent) (207). The factors which influence the cause and management of hemothorax previously discussed in connection with non-penetrating chest wounds are applicable to hemothorax complicating penetrating wounds. However, the danger of infection in the latter, especially in war wounds, is greater. As previously stated there is still some controversy regarding the management of traumatic hemothorax with opinions varying between ultraconservatism and radical operation. There is fairly general accord that moderate hemothorax in so-called closed penetrating chest wounds occurring in civil life should be treated conservatively. In contrast to these more conservative views on the management of such injuries, Schrire (383) in a recent consideration of the subject is inclined to radical therapy even in stab wounds, occurring in civil practice. He states that unless the condition of the patient was so bad as to render any operative intervention an entirely hopeless procedure, every patient with a penetrating wound of the chest admitted under his care was subjected to an exploratory thoracotomy as an emergency measure if seen within twelve hours of the injury. Aspiration is usually delayed unless dyspnea becomes manifest. Others advocate immediate aspiration with air replacement. Allen (4) suggested that a simpler way of removing the blood from the pleural cavity than by aspiration is to close the wound in the chest wall and have the patient "lie with the closed hole down in the most dependent position," thus permitting gradual leakage of the hemothorax. More recently Nicolosi (304) and Caldarera (79) have recommended alcoholization of the intercostal nerves in these cases as originally suggested by Latteri (243), in 1933, in an attempt to limit movement of the injured lung and chest and thus control the hemorrhage. That the conservative method of therapy is suitable for hemothorax occurring in civil wounds of the chest is shown by the relatively low mortality rates reported by various authors. The mortality following this method of therapy was 6 per cent in Elkin's (130) series and 4.3 per cent in Cato and Norman's (80) series. Moreover, the incidence of infection in these cases was extremely low (133).

On the other hand, in penetrating war wounds of the chest operative intervention will be more frequently indicated. This is reflected in the writings of a number of surgeons whose experience in the last World War led them toward this conclusion (5, 16, 111, 115–119, 134, 157–160, 169, 171, 192, 205, 217, 262, 264, 357, 469). Duval (119) states that up to August, 1916, such wounds were not treated by operation and the general mortality, not including "a large number of deaths which occurred in the advanced posts and in the base hospital," was 30 per cent. The two most important factors in this high mortality

were hemorrhage and infection. As has been previously emphasized, infection is much more significant in war wounds than in civil wounds, and was primarily responsible for the tendency toward operative intervention in the latter part of the war. In an analysis of 115 cases of penetrating chest wounds which occurred during the last World War, Heuer and his coworkers (206) found that 20 per cent were infected. Similarly Bradford (55, 56) and Bradford and Elliott (59) in a study of 170 cases found this incidence to be about 37 per cent, and Shipley (394) recorded an incidence of 40 per cent in 100 cases. That this is also an important consideration in the present conflict is shown by Livingstone (261) who reports that, "of 115 cases of haemothorax seen recently, 30 per cent were infected." Following the more radical form of therapy used during the latter part of the last World War, Duval (119) states that the mortality decreased to 9 per cent. On this basis he concluded that "surgical treatment of the lung should, therefore, be considered as the logical prophylactic procedure to prevent sepsis." A similar opinion was expressed by Gask (157) who in commenting upon the fact that infection was one of the most important considerations in these wounds stated that "the principle, therefore to be aimed at is the early mechanical cleansing of the wound, both of the chest wall and of the injured viscera, the evacuation of all foreign bodies and of effused blood from the pleural cavity, the repair or suture of the damaged lung and the closure of the chest cavity by suture." As regards the significance of foreign bodies Turner (437) states, "After four years' experience of war surgery, I am more and more impressed with the general truth of the proposition that sooner or later a foreign body wherever situated, tends to give rise to trouble." Similar observations have been made by others (148, 232, 251). The indications for early operation as presented by Duval and Gask (115–119, 157–159), in addition to certain types of wounds of the chest wall previously considered, include large hemothorax which cannot be evacuated by aspiration, probably because of massive clotting, the retention of large foreign bodies within the chest, and "every wound of the lung which on fluoroscopic examination shows a large intrapulmonary haematoma." More recently Mitchiner and Cowell (290) concurred with Gask and Duval on these indications. Similarly Thomas (423) in a consideration of this subject stated that "definite indications for operative intervention during the six hour interval" consisted of: "(1) Wounds producing an open pneumothorax, more graphically called sucking wounds; (2) haemorrhage which is overt and progressing; (3) haemothorax with a retained foreign body; (4) haemothorax where there is reason to suspect, from the direction of the injury, the position of the foreign body or other radiological or clinical evidence, that the diaphragm, heart or pericardium has been injured." In other recent contributions to this subject somewhat similar views have been expressed (69, 178, 200, 233, 293, 302, 308, 355, 357, 358, 429, 440). From the foregoing discussion it would seem that operative intervention is not indicated in these cases in the presence of through-and-through wounds caused by rifle bullets producing small clean wounds of the chest wall with little hemorrhage, in cases having no rib fracture, and if the retained foreign body is small (115–119, 157–159, 422, 423). However, as emphasized by Thomas (423), "there will be many borderline cases which will be dealt with at the discretion of the individual surgeon." The advantage of early intervention especially in progressive massive hemorrhage has been recently dramatically demonstrated by Monod (292), who reported 2 cases of perforating chest wounds due to pistol bullets. In both cases, which were suicidal attempts, there was injury to one of the large pulmonary veins, and the operation, consisting of lobectomy and performed within forty-five minutes after the injury, resulted in recovery. A somewhat similar case has been reported by Whitaker (460) in which the stab wound involved the left superior pulmonary vein. Operation in this case consisting of thoracotomy, exposure of the lacerated vein, and closure of the opening in the vein was also successful. Obviously such heroic procedures would be practically impossible to apply in war wounds.

No attempt will be made here to discuss technical considerations of operative intervention in these cases as they have been adequately presented in previous publications (94, 115–119, 157–160, 206, 264, 290, 357, 422, 423, 469). Suffice it to say that these consist essentially of thorough surgical revision of the wounds of entry and exit with removal of all loose rib fragments and devitalized tissue. While thoracotomy may be performed through one of these wounds if conveniently situated, ample exposure is important and exploration through a poorly placed incision should be avoided. The pleural cavity must be emptied of all blood and clots and a careful search made for retained foreign bodies and injury of the intrathoracic structures. In diaphragmatic wounds the subdiaphragmatic area should be carefully examined by enlarging the wound radially. Following necessary corrective procedures within

the chest the wound in the chest wall is carefully closed and intercostal catheter water-sealed drainage instituted. If there is no evidence of infection the tube may be removed in from forty-eight to seventy-two hours.

Infected hemothorax forms one of the most frequent complications of penetrating chest wounds occurring in warfare. This is due to the fact that in such injuries tissue damage is likely to be more extensive and dirt, débris, bits of clothing, shell fragments, and other foreign bodies are more apt to be carried and retained in the chest. The gas bacillus, streptococcus hemolyticus, streptococcus viridans, staphylococcus, and pneumococcus are the predominating organisms (136, 206, 217, 357). The characteristic clinical manifestations consist of high fever, chest pain, dyspnea, tachycardia, restlessness, and other evidences of toxemia. In anaerobic infections the clinical picture is much more striking (136). The patient appears seriously ill within a relatively short time. Dyspnea, tachycardia, and thoracic pain become marked and anxiety apparent. Restlessness may progress to actual delirium. The cheeks appear flushed and an icteric conjunctival tint or even actual jaundice are frequent. Evidence of gas within the chest becomes obvious and is frequently under unusually high pressure (136). The relative frequency of anaerobic infection in war wounds of the chest is shown by the statistics of Elliott and Henry (135, 136), based on cases occurring during the last World War. They found that in 195 (39 per cent) of the first 500 specimens of hemothorax infection was present and of this number 87 (17.4 per cent) were due to anaerobic organisms. An excellent consideration of this subject is presented by these authors.

As previously emphasized early diagnosis of infection in hemothorax is essential and delay until characteristic manifestations become apparent should be avoided. For this reason the presence of infection should be determined by careful examination of the aspirated fluid by gross appearance, odor, smear, and culture studies. Once the diagnosis has been established prompt and appropriate therapy should be instituted as previously considered. In anaerobic infections, Elliott and Henry (136) state that the ideal method of treatment should aim at removing the gas, infected fluid, septic blood clots, and foreign bodies; extinction of the infecting organisms; and inducing rapid re-expansion of the collapsed lung. However, they sadly admit that in actual practice "this complete ideal has not been attained;" but open drainage is necessary, and clots and foreign bodies, if accessible, should be removed.

The use of sulfonamide drugs in the prevention and treatment of infections in these chest injuries has been receiving increasing attention. Schrire (383) believes that "this has had a considerable effect in reducing the incidence of infection." Herrell and Brown (204) in an investigation of the local use of sulfamido compounds in the treatment of infected wounds obtained results which were "exceedingly encouraging in the treatment of wounds involving the thoracic cavity." In their opinion the best method of application consists in the use of a thick suspension prepared by adding 2 gm. of powdered sulfanilamide to 100 c.c. of an 0.8 per cent solution of sulfanilamide in normal saline solution. This suspension should be instilled into the wound or pleural cavity thrice daily. In a recent discussion of war wounds of the chest Livingstone (261) directs attention to the value of sulfonamides and states that they have used sulfapyridine principally, both for prophylaxis and treatment, in view of the possibility of pneumococcal infection. Tubbs (435) refers to a case of thoraco-abdominal injury in which clostridium welchii organisms were present and intensive chemotherapy was employed. He states that the sulfanilamide modified but did not abort the infection. Jeffrey (219) has recently presented a detailed discussion of the therapeutic use of sulfonamides in war wounds occurring in the current European conflict. According to this author the local application of sulfonamides either in an emulsified form or by spray was more beneficial than the oral administration. He states that Colonel Colebrook of the B. E. F. had supplies of the powder available at the casualty clearing stations and base hospitals with the idea that it might be of value in (1) those cases in which débridement and primary suture could be performed and in which débridement must be less radical than is desirable; (2) in accelerating the healing of septic wounds; and (3) in possibly permitting primary suture at a relatively late period, i.e., from twenty-four to forty-eight hours after the injury, if the drug was applied on the battlefield at the field ambulance. In the cases with entry and exit wounds the track was incised, cleaned of devitalized tissue and foreign bodies, and packed with sulfonamide. Unfortunately, few cases of intrathoracic injuries were available for statistical study. In their recent consideration of war wounds of the chest Roberts and Tubbs (358) state that up to the present, "the evidence favors a diminution in the incidence of infection and a decrease in the severity of toxemia when infection does arise as a result of the prophylactic use of the sulfonamide drugs." In his discussion of wound

sepsis in thoracic surgery Hart (191) states that "at the present state of our knowledge of sulfonamides a suitable one of these should be sprinkled in the wound to inhibit bacterial growth." Gask (159) has recently summarized the present attitude toward chemotherapy in war wounds. In the consideration of sulfonamides for this purpose he admits that their value cannot be accurately estimated nor is it possible to determine "how far or how successfully sulfanilamide can be used prophylactically to prevent infection occurring in wounds . . . . . Nevertheless, it may be said that there is a general impression among surgeons, who have used it in the recent air raids, that it is of real value and, if used intelligently, may supplement, although not replace, mechanical cleansing of wounds." Similar views have been expressed by numerous other observers both in civil and war surgery (54, 78, 87, 147, 154, 155, 193, 226, 252, 256, 289, 318, 342).

Penetrating wounds of the heart which have surgical significance occur relatively rarely. This is probably due to the fact that such wounds especially in warfare are almost immediately fatal. Even in civil practice their incidence in chest wounds that reach the hospital is very low. Bigger (39) reports an incidence of 0.1 per cent among surgical patients at the Medical College of Virginia Hospitals, and Elkin (130–133) states that their incidence is about 2 per cent in penetrating wounds of the chest. In Boland's series (50) of 1,187 cases of penetrating chest wounds at the Grady Hospital in Atlanta there were only 16 (1.4 per cent) cases of heart injuries. The majority of these wounds amenable to surgical intervention are stab wounds produced by a knife blade or an ice pick. Gunshot wounds are almost invariably fatal although cases have been recorded in which the patient has recovered and a bullet had remained in the heart for periods varying from several years to more than twenty years (138, 144, 203, 250, 344, 416, 438, 439). Decker (106) has recently presented an extensive review of the literature on this subject and summarized the results of 109 collected cases of foreign bodies in the heart and pericardium. The characteristic clinical manifestations produced by penetrating wounds of the heart which are not immediately fatal are the result of cardiac tamponade. A detailed discussion of these features will not be attempted here as they have been adequately presented in a number of recent publications (36–41, 97, 131, 341, 452). Briefly the mechanism of cardiac tamponade is based on the rapid disturbances in intrapericardial pressure relationships following a penetrating wound of the myocardium. Because of the limited distensibility of the pericardium, as blood accumulates in the pericardial cavity the intrapericardial pressure rapidly rises to a point which soon affects the filling and emptying of the heart and unless promptly relieved will quickly cause cessation of the cardiac function. The train of symptoms which follow cardiac tamponade are quite characteristic and consist essentially of weak heart sounds and peripheral pulse, decreasing arterial pressure, increasing venous pressure, unconsciousness due to cerebral anemia, prominence of the veins, especially those of the neck, and cyanosis particularly of the face, lips, and tongue. In addition to these manifestations, and the history, position and direction of the wound the diagnosis is further supported by fluoroscopic examination (37, 41) which reveals diminution in cardiac pulsation.

For purposes of convenience in the management of these cases Mayer (280) and Bigger (39) classify these heart injuries into four groups:

1. Patients with definite cardiac injury but with slight or moderate intrapericardial or intrapleural hemorrhage. In such cases the wound may involve the wall of the heart as well as the pericardium but without complete penetration into the cardiac chambers. Acute cardiac tamponade is usually absent and conservative management is sufficient.

2. Patients with definite cardiac tamponade which is satisfactorily relieved by conservative measures. However, if after pericardial aspiration there is evidence of recurring hemorrhage, operative intervention should be instituted.

3. Patients with rapidly developing severe tamponade which does not respond to conservative measures and in which prompt operative intervention is required.

4. Patients with massive intrapericardial and intrapleural hemorrhage. While operation should be done immediately in these patients the procedure is usually futile.

In the majority of penetrating wounds of the heart prompt operative intervention will be necessary. Bigger (40) estimates that about one-fifth of the cases are suitable for conservative treatment. This consists essentially of supportive measures such as morphine, transfusions, and other measures to combat shock and of aspiration of blood from the pericardial cavity to relieve tamponade. A number of cases have been reported in which this form of therapy was successfully applied (40, 398, 413). In those cases in which operative intervention is clearly indicated, the procedure, consisting essentially of cardior-

rhaphy, should be performed as soon as possible. Occasionally the injury involves the pericardium only, but because of the possibility of hemorrhage from the pericardiophrenic artery operation is necessary (257). Adequate exposure is essential and various approaches have been advocated (11, 103, 120, 288, 405). Technical considerations in exposure and suture of wounds of the heart will not be discussed as they have been adequately described in numerous publications (23, 36–41, 131, 132, 274, 277, 343, 382, 403, 439).

It is indeed gratifying to observe the ever-increasing number of surgically treated heart wounds and the steady decrease in operative mortality. In 1937 Ludlum and Katz (267) were able to collect 423 cases in which operation was performed. Approximately thirty years ago the mortality incidence was over 60 per cent (335), but recently a number of reports have appeared in which this incidence varied from about 35 per cent to 40 per cent (40, 132). Moreover, the late results in cardiorrhaphy are good even in cases necessitating ligature of branches of the coronary artery (291, 319).

Penetrating wounds of the chest involving other mediastinal structures such as the large vessels, trachea and main bronchi, esophagus and thoracic duct are extremely serious and usually fatal. Such injuries are characterized by massive hemothorax or hemopneumothorax, extensive and alarming mediastinal emphysema, chylothorax, and, in those cases which survive the immediate trauma, mediastinitis. Injuries of the large vessels producing progressive and massive hemothorax require prompt surgical intervention. Similarly, perforating wounds of the trachea and main bronchi demand operative therapy. Relief of mediastinal emphysema is urgently required and may be obtained by cervical incisions as previously described or possibly by tracheotomy in cases of tracheal injury. However, the best results will probably be obtained by attacking the source. Injuries of the esophagus are rarely the result of penetrating wounds of the chest but most commonly follow instrumentation or the swallowing of sharp foreign bodies. In perforations of the esophagus following penetrating chest wounds immediate surgical intervention is indicated. The wound should be carefully débrided and repaired and drainage instituted. The various approaches to the thoracic esophagus have been previously described (313, 315). The principle danger in such injuries is infection and the rapid development of mediastinitis. As previously emphasized (311) in such instances prompt institution of a drainage is imperative "because most of these infections are anaerobic, and the institution of drainage not only permits the evacuation of its contents but also produces aerobiosis. In cases in which there is infection with anaerobic organisms, irrigation of the wound with oxidizing agents is important." The various techniques of mediastinotomy for instituting drainage in these cases have been described (75, 303, 311, 334).

Injuries of the thoracic duct are manifest by the escape of chyle and the production of chylothorax. A number of excellent reviews on traumatic chylothorax have appeared in the literature and only a succinct consideration of the subject will be presented here (70, 102, 167, 189, 259, 270, 298, 391, 412, 443, 470). According to these reports traumatic chylothorax occurs relatively rarely. Thus, in 1912, Zesas (470) was able to collect only 18 recorded cases. Twenty years later Macnab and Scarlett (270) brought this total up to 34 cases. In 1935 Lillie and Fox (259) reported the forty-sixth case and since then there have been a few more (81, 163, 167, 279). Injury to the thoracic duct with consequent chylothorax may occur during operative procedures in the neck or thorax, may be caused by the penetrating agent, or may follow some type of trauma such as crushing injuries in which the chest is not penetrated but in which the duct is torn by fractured rib fragments or ruptured probably as a result of the compression together with an increased intraductal pressure which may be present following a heavy meal (254). It would seem that the majority of cases follow non-penetrating injuries. Thus in Macnab and Scarlett's (270) series of 33 collected cases, 27 (81.8 per cent) were due to crushing injuries and only 6 (18.1 per cent) followed penetrating chest wounds. In 1936 Strauss (412) reported a case following a bullet wound and was able to find only 7 other cases in the literature. More recently another case was reported by Matson and Stacy (279). Traumatic chylothorax occurs most frequently on the right side. Of 28 cases reviewed by Macnab and Scarlett (270) 15 were on the right side, 8 on the left, and 5 were bilateral. Clinically the three most striking features according to Lillie and Fox (259) are: "the latent period before the onset of the symptoms, the rapid reaccumulation of the fluid within the chest after aspiration, and a gradual progressive emaciation which frequently ends in death." The average duration of the latent period is about four days. The clinical manifestations develop suddenly and dramatically with all the symptoms and signs of profound shock. Examination of the chest reveals evidence of pleural effusion and on aspiration, which combined with

other appropriate measures usually relieves the manifestations of shock, the characteristic chylous fluid indicates the diagnosis. In this connection it is important to distinguish between true chylous fluid and pseudochylous fluid. There are a number of physical and chemical determining factors in their differentiation (448). The unusually large amounts of fluid and the rapidity with which it reaccumulates following aspiration are quite characteristic. Cases have been reported in which the amounts aspirated varied from 20 liters in ten days (349) to 52 liters in thirty-four days (259). The grave prognosis in traumatic chylothorax is shown by the fact that the mortality in the reported cases is about 50 per cent. In Mouchet's (298) collected series of 43 cases, the mortality was 41 per cent and this incidence in Macnab and Scarlett's (270) series was 53.3 per cent. Obviously the prognosis is better in injuries of the thoracic duct occurring at operation and limited to this structure. In the fatal cases death may be immediately due to suffocation and cardiac failure as a result of the massive pleural effusion or be delayed for several weeks with terminal features of inanition, emaciation, and asthenia. The management of traumatic chylothorax following injuries of the thoracic duct is more or less unsatisfactory as surgical repair of the defect is impracticable although ligation may be advantageously done in cervical injuries. Various forms of therapy, some of which are contradictory, have been suggested including the administration of large amounts of fluids by mouth, the restriction of oral fluids and their rectal administration (180), the administration of a fat-free diet (259) and a diet rich in fats, the use of blood transfusion and glucose-saline mixtures and the avoidance of glucose infusions (81), the production of positive intrathoracic pressure to favor compression and closure of the duct by thoracotomy, thoracoplasty or artificial pneumothorax which appears irrational, the use of gomenol and oil injections (279), the intravenous re-introduction of the aspirated chyle (19, 317, 399, 455) and the performance of phrenicotomy (310). It would seem that probably the best plan of management should consist of the use of supportive measures and emergency aspiration to relieve cardiorespiratory embarrassment. If the aspirated chyle is sterile its intravenous reintroduction appears rational.

Injuries to the diaphragm resulting in traumatic diaphragmatic hernia may follow blunt non-penetrating trauma causing a bursting tear of the diaphragm or may be due directly to the penetrating agent as in stab and gunshot wounds. Diaphragmatic hernia may be etiologically classified into congenital, acquired, and traumatic (198, 199). In a comprehensive consideration of this subject in 1934 Hedblom (198) found that in a collected series of 1,003 cases reported since 1900, 34.9 per cent were of traumatic origin. Apparently the incidence of penetrating and non-penetrating trauma as a cause of diaphragmatic injury is about equal. In Hedblom's (198) series of 318 civil traumatic cases 52 per cent followed penetrating injuries and 48 per cent non-penetrating. Of the former 70.3 per cent were stab wounds, 21.3 per cent gunshot wounds, and the others were probably due to operative injury. In the non-penetrating group 36.6 per cent resulted from falls, 22.8 per cent from crushing injuries, 10 per cent to "jackknifing" injuries, and the remaining to violent strain. More recently the incidence of the non-penetrating type may be increased due to the great frequency of automobile and airplane accidents. In war wounds the penetrating type is probably more frequent. In this connection, however, Gordon-Taylor (168) recently stated that "in contrast to the last great European conflict non-penetrating injuries of the abdominothoracic zone do not play the same small and infrequent part in war surgery today." In Hedblom's (198, 199) series there were 127 cases due to war injuries, of which 44 were caused by bullets, 32 by shell fragments, and 2 by bayonets. As might be expected, on the basis of anatomical considerations the left side is much more frequently involved than the right. In a series of 291 collected cases approximately 95 per cent were on the left side (199), of which approximately one-half were laterally located and one quarter centrally situated. Bilateral involvement is occasionally reported (285). Characteristically the clinical manifestations of traumatic diaphragmatic hernia vary considerably and depend to a great extent upon the size, position, and contents of the hernia as well as other associated injuries. In the non-penetrating type the most common immediate symptoms are shock and pain and other manifestations previously considered in crushing injuries. Dyspnea, tachycardia, upper abdominal tenderness, and rigidity and pain referred to the neck and shoulder are characteristic manifestations. In the penetrating form in addition to shock and pain there may be pneumothorax, hemothorax and other manifestations of associated intrathoracic injury. Later in both types there may develop symptoms referable to the thorax, abdomen, or both, which depend upon the size, position, and contents of the hernia and their consequent interference with cardiorespiratory

and gastro-intestinal functions. It should be realized that not infrequently patients are symptomless for long periods, and manifestations may not become apparent until years later. Eliot (129) reported a case in which the patient received a bayonet wound in the left side during the World War. This apparently healed promptly with no complications, but about twelve years later he noticed a swelling in the scar and sharp pain in the chest immediately after lifting a heavy trunk. At operation it was found that this was due to the herniation of omentum through an opening in the diaphragm. Bayonet wounds of the diaphragm apparently occur very rarely as in a series of 50 cases occurring during the last World War Bryan (71) states he never observed this type of injury. The physical findings are usually limited to the chest and also may vary considerably especially with postural changes. These include a changing percussion note over the lower thorax, borborygmi, and partial dextrocardia. The diagnosis of traumatic diaphragmatic hernia is frequently difficult to establish especially at the time of injury. That such injuries are commonly overlooked is demonstrated by Hedblom's (197) finding that of 127 cases during the last World War "over 40 per cent had symptoms from one to fifteen years before the diagnosis was made." Similar observations have been made by others (307, 379). For this reason the condition should be suspected in all thoracic injuries and especially in penetrating wounds of the lower thorax. Later the diagnosis is based upon the history of an injury, the presence of clinical manifestations, and roentgenological demonstration of an abdominal viscus above the diaphragm. Strangulation, usually of the omentum or a part of the colon but occasionally of the small bowel or stomach, is an obviously serious complication (71).

In the management of diaphragmatic wounds shock and other manifestations of the injury may require immediate attention. However, as soon as it is permitted by the patient's condition, surgical repair of the hernia should be done (275). Technical considerations of the operation will not be reviewed here as they have been presented in numerous previous publications (71, 185–187, 196–199, 377, 409, 430–432, 456). Several approaches have been employed including thoracotomy, laparotomy, or a combination of both. The indications, contraindications, advantages and disadvantages of each method have been discussed previously (197–199). In traumatic diaphragmatic hernia, especially if associated with other thoracic injuries, it would seem that the thoracic approach is more desirable. However, the approach should be determined by the indications in the individual case. Interruption of the phrenic nerve by novocaine injection or preferably by crushing facilitates the operation (9, 140, 185–188, 197, 199). In those cases in which operation is performed immediately after the injury careful exploration of the subdiaphragmatic region should be done to determine the possibility of damage to structures in this area. The prognosis in non-complicated cases is fairly good. Immediate fatalities are usually due to other more serious injuries although cases have been reported in which the diaphragm only was injured (88). Thus, in 12 cases due to gunshot and stab wounds recently reported by Steinke (406, 407) there were 8 deaths (66 per cent) all but 1 of which were due to hemorrhage. Hedblom (197–199) found that the operative mortality in the collected series of civilian cases was 17 per cent in the non-obstructed group and 81.6 per cent in the obstructed. In war injuries these respective figures were 26.3 per cent and 37.6 per cent. More recently Harrington (186) reported 210 cases of diaphragmatic hernia including 36 of traumatic origin with a total operative mortality of 4.3 per cent.

Because of their relative gravity thoracico-abdominal wounds deserve especial consideration. In the American Expeditionary Forces during the last World War these wounds comprised 4.6 per cent of all thoracic injuries admitted to the evacuation hospitals (247). According to Taylor (420) in the British Forces during this war these wounds constituted about 9 per cent of the thoracic wounds admitted to a casualty clearing station and about 12 per cent of the abdominal cases. Similarly in the Spanish Civil War these wounds comprised 11 per cent of all abdominal wounds (221). Penetrating injuries and especially war wounds are the more serious forms because not infrequently they are multiple. In a consideration of this subject Duval (14) states that if the wound of entry is in the chest the more serious lesions are likely to be thoracic whereas if the entry wound is abdominal the graver lesions are more apt to be in the abdomen. Obviously in multiple wounds any of the thoracic lesions previously considered may be encountered as well as involvement of the various intra-abdominal viscera. Diaphragmatic wounds are frequent especially in injuries of the lower thorax, and herniation of abdominal viscera, especially on the left side, occurs in about 10 per cent of these cases (247). Bryan (71) has presented an excellent review of this complication of thoracico-abdominal wounds occurring in the last World War. Lee

(247) states that a hollow abdominal organ is penetrated in approximately one-third of the cases and that "an uncomplicated liver injury is more common than one of the spleen." It should be realized also that thoracico-abdominal lesions with rupture of the liver or spleen may follow crushing injuries (98). Heyd (209) classifies thoracico-abdominal injuries into six types: "(1) The perforating wound through the costophrenic sinus with minimum degree of damage to diaphragm and which was characterized usually by slight, if any, visceral lesion. (2) Penetrating wound with orifice of entry high on the thorax, perforating the lung and penetrating the diaphragm with moderate or severe visceral injury. (3) A wound low down in the axillary line, usually in the seventh, eighth, or ninth intercostal space, with injury to the liver, spleen, and stomach, with gross hemorrhage into the abdomen, and rarely perforation of the colon or small intestine, and in which the entire picture was dominated by the abdominal injury. (4) A wound low down in the axillary space with considerable loss of lateral chest wall and diaphragm, resulting in herniation or prolapse of the omentum and abdominal viscera into the thoracic cavity or externally. (5) A wound in the lumbar region with injury to the kidney and associated with injury to diaphragm and abdominal viscera. (6) Tangential wounds of the chest and abdominal wall with a concussion haemothorax and suspected chest and abdominal injury, but which upon operation proved to be superficial and without injury to either thoracic or abdominal viscera."

In addition to shock, which is almost invariably present early, the clinical manifestations are variable and depend upon the extent and type of visceral involvement. Accordingly, there may occur hemothorax, pneumothorax, emphysema, or any of the manifestations previously considered in thoracic injury. Rarely bilithorax or cholothorax has been encountered (49, 135, 414). In addition to these manifestations abdominal pain, localized tenderness and rigidity especially in the upper part of the abdomen, vomiting, and evidence of intraperitoneal hemorrhage are frequently present. It should be realized that pseudoperitoneal reactions may occur in injuries of the lower thorax (271, 397) with resultant confusion in diagnosis. Maillet (271) has directed attention to this possibility which he refers to as "syndrome-phreno-diaphragmatique." Upper abdominal pain, tenderness, rigidity, and even manifestations of ileus may be present. However, the subsequent course of the condition reveals the injury to be primarily thoracic. In some instances the manifestations are due to injury or irritation of the intercostal nerves (358) and the diaphragm. In this connection Gordon-Taylor (168) states that whereas "abdominal rigidity associated with an injury below the diaphragm is more likely to be bilateral," such rigidity accompanying thoracic wounds "is usually confined to one side." Moreover, in chest injury the abdominal rigidity "tends to be intermittent, some relaxation of the rectus abdominus occurring during inspiration." Roentgenological studies in the diagnosis of these injuries are obviously indispensable.

In the management of thoracico-abdominal injuries certain principles of therapy have been established and depend upon the type of injury. Obviously shock must be combated before other active therapeutic measures are instituted except in the presence of those thoracic injuries previously considered, such as tension or valvular pneumothorax and "sucking" wounds, which demand immediate attention. In cases of open pneumothorax obtained early, some advise immediate operation with débridement of the chest wall and radical enlargement of the diaphragmatic wound to permit exploration of the diaphragmatic area. In through-and-through wounds on the right side with probable liver penetration conservative therapy is probably indicated unless continuing hemorrhage becomes manifest. According to Gordon-Taylor (168) surgical intervention in injuries of the liver is indicated (1) in gross hemorrhage from this organ, (2) in the presence of an associated thoracic or "abdominal lesion demanding exploration, and (3) if a large missile is retained in an accessible part of the liver." In diaphragmatic injuries associated with kidney wounds it is considered preferable "to do the posterior surgery first" (209). In wounds on the left side with splenic injury, splenectomy is probably the procedure of choice especially if abdominal exploration seems warranted. Gordon-Taylor (168) states that "suture of the spleen may not be difficult when the organ is approached through the chest and diaphragm, but when explored by other routes cobbling of the organ is wasteful of time and may leave a sense of insecurity." He refers to a number of successful transdiaphragmatic splenectomies in abdominothoracic wounds on the left side during the last World War. In some of these cases this was associated with nephrectomy and repair of gastric wounds. In cases of small penetrating thoracic wounds with abdominal injury especially of the hollow viscera operative intervention directed at the abdomen is indicated and the thoracic lesion may be temporarily disregarded (411). Such in-

juries usually involve the stomach and splenic flexure of the colon. On the other hand if the wound involves the thorax, diaphragm, and abdomen and the thoracic injuries are sufficiently serious to warrant operation, surgical intervention should be directed toward the chest injury and the upper abdomen may be approached through the diaphragm. Occasionally it may be necessary to explore both the chest and abdomen through separate openings or through a vertical incision over the chest with section of the costal cartilages and prolongation of the incision into the abdomen (117).

The prognosis in these injuries is obviously grave. Heyd (209) stated that during the last World War "in the forward area" the mortality was usually 60 per cent, but not infrequently 75 per cent. According to Taylor (420) it is "largely determined by the nature of the abdominal injury." Thus, the cases associated with wounds of a hollow viscus had a higher mortality. In his series of 75 cases Taylor found that while the mortality incidence was 50 per cent in the cases accompanied by injury to a hollow viscus, in those with wounds of a solid viscus it was 30 per cent. The total operative mortality in a collected series of 207 cases occurring during the last World War was 33.3 per cent. According to Gordon-Taylor (168) the prognosis is worse in "wounds that traverse the diaphragm from below upwards" than in those "in which the missile has passed from thorax to abdomen."

Because of its particular significance, it is deemed desirable to consider briefly the problem of anesthesia in chest injuries. The importance of anesthesia in war wounds and military surgery has been recently emphasized by Metcalf (284) and Crane and Sankey (96). Anesthesia in elective thoracic surgery presents certain distinctive difficulties which have been generally realized (26–29, 139, 208, 211, 216, 269, 340, 366, 376, 462). However, in chest injuries the problem is further complicated by the presence of anoxia, shock, and other factors which may embarrass cardiorespiratory function such as rib fractures, massive atelectasis, tension or open pneumothorax, massive hemothorax, varying degrees of pneumonitis, and intrapulmonary hemorrhage. In a recent consideration of this subject Halton (181) has directed attention to the fact that "wound shock, through the direct action of nervous impulses and tissue metabolites on the respiratory enzyme, reduced cytochrome, interrupts the cycle of cell respiration and oxidation," and that "morphia and the anesthetic drugs acting on another respiratory enzyme, dehydrogenase, further tend to retard the vital cycle and to produce oxygen starvation of the tissues." Obviously operative intervention should be avoided in the presence of shock except under the unusual circumstances previously considered. However, even in those cases of chest injuries in which the surgical procedure has been delayed and a sufficient period has elapsed for readjustment, there are present a number of factors which "render the margin between oxygen sufficiency and oxygen lack very narrow" (181).

Apparently there is some diversity of opinion regarding the most desirable method of anesthesia in these cases. Halton (181) is opposed to the closed circuit method because it is "mechanically and physiologically inadequate." He states that whereas the mediastinum and lung can be stabilized "if the gases are given under pressure, . . . the increased effort of expiring against this pressure has the same effect as if the patient were breathing ordinarily with one side of the chest open. Again, though the exhaled gas is washed clean of carbon dioxide the air which passes from lung to lung never reaches the absorbing medium so the vicious circle described above is never broken. Its effects are merely delayed and minimized for a short time. Moreover, if the other pleural cavity is opened by accident or intent, it is impossible with this form of anesthesia to keep the patient alive for more than a short time." Halton (181) considers intratracheal insufflation the method of choice in either immediate or delayed procedures and uses ether or chloroform because although nitrous oxide or cyclopropane may be "ideal in theory" they are "too expensive for general use." Moreover, he prefers not to employ premedication such as morphine or intravenous barbiturates in the majority of cases "because of their depressant effect on the respiratory centre which is already overburdened." On the other hand, Nosworthy (309) states that "in practically all these war cases" he has employed "controlled respiration, using the carbon dioxide absorption, technique," because in his experience it is the only method "which permits normal respiratory physiology to take place while the chest wall is wide open." In discussing his reasons for using this method of anesthesia he states further that it "completely prevents paradoxical respiration, mediastinal flap, and all disturbances from sucking wounds. Both pleural cavities can be opened simultaneously without harm. The patient's existing vital capacity is used to the full. In view of the adequate oxygenation and efficient removal of carbon dioxide, even very ill patients stand up to prolonged operations so well that one has come

to expect them to be no worse, and commonly better, at the conclusion of the operation. The surgeon's work inside the chest can be made less difficult, and at the end it is almost always possible, if one so desires, to leave the lung on the affected side fully expanded." He uses cyclopropane which he considers the anesthetic of choice. It "is non-toxic, of short action, and permits the use of a high concentration of oxygen." Moreover, he also employs premedication and for this purpose administers "morphine and scopolamine with or without an intravenous injection of pentothal sodium." Westell (458) also prefers intravenous induction and states that in his experience intravenous anesthesia "combined with endotracheal insufflation of oxygen under pressure, supplemented by nitrous oxide if necessary" has been found excellent. During the last World War there was also some diversity of opinion regarding the preferable method of anesthesia. In the American Forces "positive pressure anesthesia, or, better, analgesia" was considered "the most important single factor in successful thoracotomy under war conditions" (469). Nitrous-oxide-oxygen was employed with the Gwathmey apparatus and morphine was used in premedication. On the other hand, the French and English Surgeons preferred open anesthesia or local analgesia (5, 115, 160, 171, 192, 262, 264, 357, 440). As previously emphasized in the consideration of anesthesia in intrathoracic surgery "the most important desiderata are complete control of intrapulmonic pressure, adequate facilities for aspiration of secretions in the respiratory passages during the operation, the maintenance of quiet respirations and high oxygenation, the avoidance of distressing cough reflex, and the rapid return to consciousness following completion of the operation" (314). Although there is some diversity of opinion concerning the most desirable method of anesthesia in these cases, there is undoubtedly general agreement that a highly trained anesthetist, skilled in the management of cases requiring thoracic surgery, is extremely important. As emphasized by Thomas (423) "only those of us who constantly practice thoracic surgery . . . fully appreciate how much a successful outcome depends on the skillful anaesthetist in a difficult case."

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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

EYE

Spiegel, E. A., and Scala, N. P.: Vertical Nystagmus Following Lesions of the Cerebellar Vermis. *Arch. Ophth.*, 1941, 26: 661.

Experiments performed on 10 cats demonstrated the existence of a cerebellar type of vertical nystagmus (in addition to that caused by lesions of the vestibular nuclei). This nystagmus was noted after lesions of the lobus posterior medianus with the vestibular nuclei and their fiber systems intact. The intensity and to some extent the direction are influenced by the position of the head, being greatest with the animal in the supine position with the vertex downward. The nystagmus appeared immediately or a few hours after the animals awakened from the anesthesia and lasted only a few days. The phenomenon is considered to be due to release of the vestibulo-ocular reflex arcs from cerebellar inhibition. WILLIAM A. MANN, M.D.

Lee, O. S., Jr., and Lum, F. K.: Gonorrheal Ophthalmia; Treatment with a Sulfanilamide Derivative and Injections of Milk. *Arch. Ophth.*, 1941, 26: 268.

Seventeen children with epidemic gonorrheal ophthalmia from a children's receiving home were hospitalized and divided into 3 groups for study.

Five patients (Group 1) were given 4 injections of milk intragluteally. The ocular infection improved markedly under this treatment but still persisted after one week's observation. Sulfanilyldimethylsulfanilamide was then given orally with another injection of milk to shorten the period of study. After from one to two days of this treatment all of the patients were cured. No complications occurred.

Five patients (Group 2) were given sulfanilyldimethylsulfanilamide orally, and 3 of them had the first of 3 consecutive negative smears for gonococcus in from four to five days. Two children with corneal involvement before treatment continued to show discharge and positive smears for gonococcus during treatment with the drug alone. They required a second course of treatment, consisting of injections of milk together with the oral administration of the sulfanilamide derivative, which cured the infection after five and six days, respectively. In 1 of these 2 children a corneal ulcer developed which perforated during treatment with the drug alone.

Seven children (Group 3) were given a combination treatment with sulfanilyldimethylsulfanilamide (orally) and milk (intragluteally). Five of them had the first of 3 consecutive negative smears for gonococcus on the fifth day, 1 on the sixth day, and the last, with corneal involvement, on the tenth day, although the eye was clinically cured on the sixth day. No complications occurred during treatment.

It is shown that a combination treatment consisting of the oral administration of sulfanilyldimethylsulfanilamide and injections of milk is superior to injections of milk alone because of the more rapid rate of cure, and to the administration of the drug alone for the prevention and healing of corneal complications. Under such combined therapy, from five to seven days of chemotherapy with 2 injections of milk are probably sufficient to cure uncomplicated gonorrheal ophthalmia in the acute and subacute stages without danger of relapse. Patients with corneal complications will require 4 injections of milk and possibly up to ten or twelve days of chemotherapy.

LESLIE L. MCCOY, M.D.

Chavira, R. A.: Paralytic Syndrome of the Upper External Wall of the Cavernous Sinus. Total Motor Ophthalmoplegia (Sindrome paralitico de la pared supero externa del seno cavernoso. Oftalmoplejia total motriz). *An. Soc. mex. de oftalmol. y oto-rino-laringol.*, 1941, 16: 87.

The term "ophthalmoplegia" was first used by Brunner in 1750 and the term "total ophthalmoplegia" was used to designate a complete paralysis of the common oculomotor nerve. The classical conception was that such paralysis could be caused only by central lesions. This idea has been disproved, however, by the occurrence of cases such as those described in this article.

Two of these cases occurred in women twenty-four and thirty-three years of age, respectively. In both cases the lesion that produced the paralysis was a fracture of the external wall of the sella turcica extending forward from the posterior clinoid processes. This caused an infiltration of blood into the upper external part of the wall of the cavernous sinus and resulted in a complete motor paralysis of the third, fourth, and sixth pairs of cranial nerves. The usual symptoms of such a paralysis, which are described in detail, were produced. The prognosis in such lesions is good and in both of these cases the patients are gradually recovering a capacity for normal movements of the eye. AUDREY G. MORGAN, M.D.

Gomes, J. P.: Tumors of the Optic Nerve. *Am. J. Ophth.*, 1941, 24: 1144.

Primary tumors of the optic nerve are extremely rare; hence the report of 13 cases in Brazil, of which the author has direct knowledge, is of interest. The cases are reported in detail and photomicrographs of the operated cases accompany the article. The main symptoms noted were exophthalmos and diminution of vision. There was usually a commencing

papilledema, little disturbance in ocular motility, no pain, and sometimes, but not always, a palpable mass in the orbit. Intracranial invasion occurred, rather than intraocular extension, and this may give rise to headache, personality changes, vomiting, or even paralysis of the limbs. Roentgenological examinations should be made, especially to ascertain the comparative measurements of the two optic canals. The visual field of the healthy eye may be of some diagnostic value.

Following the classification of Hudson, tumors of the optic nerve may be considered to be gliomas arising from the nerve trunk, endotheliomas (much more rare) arising from the arachnoid or dura, or fibromas (still more rare) arising from the dural sheath. The relationship of these tumors to von Recklinghausen's disease has been studied and although any causal relation is open to question, further investigation should be made.

From a study of cases of primary tumor of the optic nerve, the surgeon may draw two important conclusions: (1) the site of origin is usually in the orbital portion of the nerve and there is not always intracranial extension; and (2) even when extirpation is incomplete, recurrences are rare. Because of these facts the author advises, in the beginning, an orbital approach rather than transfrontal craniotomy. He believes that these tumors should be extirpated with preservation of the eyeball if possible. Otherwise he favors enucleation of the eyeball followed by extirpation of the tumor, or, if the orbital cavity is involved, exenteration of the orbit. If the first procedure is possible, the author prefers the method of Lagrange, the external orbitotomy of Rollet, or the method described by Davis. He believes the Kronlein operation to be unnecessary.

If cranial extension has taken place, transfrontal craniotomy should be employed by a neurosurgeon and followed, at a later time, by the orbital approach by the ophthalmic surgeon.

WILLIAM A. MANN. M.D.

EAR

Kettel, K.: The Lempert Endaural, Antauricular Surgical Approach to the Temporal Bone: Suggested Modification of the Technique in Tympanomastoidectomy. Report of 55 Cases. *Arch. Otolaryngol.*, 1941, 34: 461.

An incision is made reaching from the apex of the trigonum suprameatum to the lower end of the anterior border of the concha, i.e., identical with Lempert's third endaural incision. The auricle with its attachments is separated from the outer cortex of the mastoid and the zygoma, and sharp retractors are introduced. At the same time the membranous covering of the entire posterior wall is separated from the underlying surface of the bone and pulled forward by means of a blunt retractor. Now the antrum is opened, and the posterior osseous wall is removed. The blunt retractor is removed from the membranous covering of the posterior wall, which is

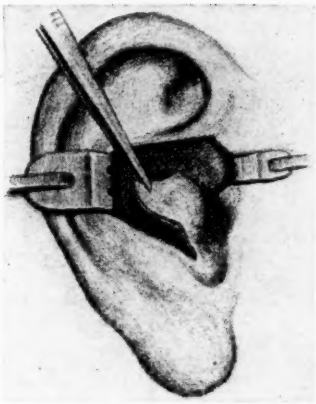

Fig. 1. A flap has been created for covering the facial ridge and the mastoid bowl.

then incised along the roof. After the subcutaneous tissue of the flap has been partially removed, it is placed over the facial ridge and the mastoid bowl. The rest of the cavity is covered primarily with Thiersch grafts, and any part of the sinus and dura incidentally exposed is left uncovered.

The advantage of the original Lempert technique in comparison with this modification is that the former allows a perfectly free view of the tympanic cavity from the beginning of the operation. The drawback is that the epithelization of the cavity is protracted, which makes the after-treatment difficult. The suggested modification offers the advantage of easier and more rapid incisions, besides that of more rapid epithelization of the cavity, stricture of the external canal being avoided. On the other hand, one does not get the same unhindered view of the tympanic cavity obtained by the original technique until the posterior osseous wall has been removed and the flap properly placed.

The author has performed 35 tympanomastoidectomies and 2 modified tympanomastoidectomies in the way described, with a fatal outcome in 1 case. In 5 of the tympanomastoidectomies the original technique was employed. Two of these operations had to be revised. In 32 cases (including a case of abscess in the temporal lobe of the brain) the modification was employed, and the results have been ideal cosmetically as well as clinically.

JOHN F. DELPH, M.D.

Lillie, H. I., and Pastore, P. N.: Repair of Postoperative Mastoid Fistula; Report of a Method. *Arch. Otolaryngol.*, 1941, 34: 687.

A review of the literature pertaining to the surgical closure of postoperative mastoid fistulas is given. A method for repair which utilizes an incision to undermine the edges of the wound so that when the wound edges are approximated a wide surface for healing is made available is described. This method

Fig. 1. Method of repair of postoperative mastoid fistula.

was found to be very successful in the authors' hands in 12 successive cases in which the fistulas were of various sizes. The use of an improved supporting suture which has proved to be very practical is also described. The operation should not be undertaken until any defect in the bone overlying the dura or sigmoid has been filled in with newly formed bone. Care must be taken in operations of this type not to permit epithelium to remain in the depths of the wound.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Wyatt, T. E., and Pilcher, C.: Experimental Cerebral Trauma. *Ann. Surg.*, 1941, 114: 321.

The water content of the dog's brain was studied in conditions which have been reported to be associated with "cerebral edema," by means of the same methods of study that were employed in previous experiments on the water content of the brain following trauma. The conditions studied were acute uremia, obstruction of the vena cava and of the azygos vein, severe fever, and intensive irradiation of the head. Specimens of cerebral gray and white matter, cerebellar gray matter, and brain stem were weighed immediately and dried to constant weight.

To produce acute uremia bilateral nephrectomy or bilateral ureteral ligation was performed in a series of 11 animals. When they became moribund two to five days after operation, they were sacrificed by stabbing through the heart. Observations were made on the blood pressure, blood non-protein nitrogen, cerebrospinal-fluid pressure, optic discs, and on the water content in the brain. The non-protein nitrogen was elevated in most of the animals. The water content of the brain tissue was found to be normal or somewhat less than normal. It is pointed out that the low fluid values in some of the experiments might have been due to vomiting and fluid deprivation. These acute experiments are not strictly comparable to such clinical states but they serve to cast doubt on the occurrence of increase in the cerebral-tissue fluid in acute uremia.

The effect of venous obstruction on the water content of the brain was studied in two groups of dogs. In one group the superior vena cava was ligated and in the other the superior vena cava and the azygos vein were ligated. In the former group edema of the scalp and papilledema did not occur and the water content of the brain tissues closely approximated normal values. In the latter group there were profound alterations in the general condition of the animals, and edema of the scalp and choked discs was observed. In 1 animal the water content of the gray matter was significantly elevated, while in the remaining animals all values for water content were approximately normal, as were the averages. An increased intracranial blood volume is believed to have existed, which would account for the increased intracranial pressure.

Fever was produced by placing the animals in a hyperthermic chamber. On removal the animals were prostrated and had very high rectal temperatures. Cerebrospinal-fluid pressures were normal in 2 instances. At necropsy the brains presented no visible abnormality. The percentage of water in cerebral and cerebellar gray matter and in the brain stem was consistently higher than normal in all of the experiments. In the cerebral white matter the percentage of water was within normal limits. It is thought justifiable to conclude that true edema of portions of the brain occurs as a result of extreme hyperpyrexia.

In a fourth group of animals deep roentgen irradiation was administered to the entire head. The average water content of the brain tissues showed no significant variation from normal, but in the individual experiments the water content varied somewhat more than usual.

This study demonstrates a remarkable stability in the water content of the dog's brain under widely varying abnormal conditions. Only the group subjected to high fever showed a consistent elevation of water content in the brain.

JOHN L. LINDQUIST, M.D.

Adson, A. W.: Cerebrospinal Rhinorrhea; Surgical Repair of Craniosinus Fistula. *Ann. Surg.*, 1941, 114: 697.

Cerebrospinal rhinorrhea may result from a number of causes, the most common of which is skull fracture that extends through the posterior wall of the frontal sinus or the cribriform plate of the ethmoid bone, with accompanying tears of the dura and arachnoid.

In surgical treatment, the procedure consists of craniotomy which will allow the dura to be elevated from the bone in both halves of the frontal fossa. The bone flap must be designed so as to extend across the midline and to uncover the anterior poles of both frontal lobes. A coronal scalp-flap incision is employed. It is placed within the hairline, after which the scalp and periosteum are reflected forward to a line just above the frontal sinus. Six trephine openings are made, the first two of which are placed on each side of the midline just above the frontal sinus. The second two trephine openings are placed on each side of the midline and the longitudinal sinus, approximately 3 cm. in front of the coronal suture. The third two openings are placed in the temporofrontal region, one on each side. As the bone between all the openings is cut with a Gigli saw, an opening is effected which is sufficient to permit elevation of the dura and the frontal lobes. The bone flap is kept sterile during the operation by means of a sponge soaked with saline solution. Caution is taken to avoid injury to the longitudinal sinus. Bleeding from the longitudinal sinus is controlled by ligation of the sinus with silk ligatures at a level of 6 cm. above the foramen cecum, which is situated superior to the crista galli. In some instances, it is necessary to ligate the longitudinal sinus where it communicates with the foramen cecum. The advantage of ligation of the longitudinal sinus allows the dura to be sutured into, and, if necessary, to be used in closure of the fistulous tract. The procedure is con-

tinued by elevation of the dura from the frontal fossa and the olfactory grooves, where it is necessary to sacrifice the olfactory nerves. The elevation of the dura is continued until the anterior crest of the sella turcica is approached. During this dissection, the fistulous tract is always encountered, whether it be situated on the right or the left side. The meninges will be seen to extend into the defect of the frontal sinus or the cribriform plate.

After the dura has been mobilized sufficiently and the fistulous tract has been identified, plastic closure of the tract is begun by overlapping of the dura in such a way as to invaginate the meningeal portion of the fistula. The first suture is placed in the most dependent part of the elevated dura. This suture is of continuous chromic catgut No. 0. The primary line of suture is protected by a strip of muscle which is transfixed to the dura and further re-enforced by the placing of a second row of interrupted silk sutures. The defect in the frontal sinus or cribriform plate is filled with Horsley's bone wax. Further to protect against forcing of the wax through the cranial defect into the sinus or nose, Lukens' animal membrane is placed over the defect before the introduction of wax to plug the hole.

Obrador Alcalde, S.: Physiopathological Factors Which Determine the Symptomatology of Brain Tumors (Factores fisiopatológicos que determinan la sintomatologia de los tumores cerebrales). *Analecta med.*, 1941, No. 2, p. 23.

This study is based on 254 verified cases of tumor of the cerebral hemispheres observed in the Neuro surgical Service of Cairns at the University of Oxford. The material includes 110 multiform glioblastomas, 61 meningiomas, 27 astrocytomas, 24 oligodendrogliomas, 26 metastatic tumors, 3 polar spongioblastomas, 2 astroblastomas, and 1 medulloblastoma.

Tabulation of the initial symptoms reported in the histories of these cases shows that the most frequent were headache (39 per cent) and epileptic phenomena taken in the broadest sense (30 per cent); then came mental changes (11 per cent), visual disturbances (4 per cent), and other disorders in decreasing percentages. Headache was found with equal frequency in the meningiomas, astrocytomas, and multiform glioblastomas (39, 40, and 38 per cent, respectively); it was less frequent in oligodendrogliomas (26 per cent) because of the occurrence of focal symptoms as the first manifestation of these tumors. The average interval between the headache and the remaining symptoms was three months in multiform glioblastomas and from ten to seventeen months in the other tumors. Epileptic phenomena as initial symptoms were found most frequently in the oligodendrogliomas and astrocytomas (45 and 44 per cent); they were less frequent in meningiomas and multiform glioblastomas (33 and 23 per cent). The average interval between epilepsy and the subsequent symptoms was twenty-seven months. The epileptic phenomena occurred in from 35 to 40 per cent of the frontal, parietal, and temporal tumors and in only 20 per cent of the occipital tumors. Mental changes as the first symptom were most frequent in tumors involving one or both frontal lobes (multiform glioblastomas), and the average interval between these changes and the subsequent symptoms was eight months. It is interesting to note exostosis of the cranial vault as the first symptom in 4 cases of meningioma, preceding the other symptoms by from one to two years. The more purely neurological focal symptoms (aphasic, sensitive, motor, and gait disturbances) began the disease picture in only 7 per cent of the cases.

Headache is usually a sign of increased intracranial pressure which depends on various factors, such as the size of the tumor, cerebral edema which is intense in multiform glioblastoma and slighter in other gliomas and in meningiomas, and hyperproduction with delayed resorption of the cerebrospinal fluid. Any obstacle to the circulation of this fluid is manifested by hydrocephalic dilatation of the ventricles situated higher up. The third ventricle is important for this circulation: tumors of varying origin may compress or invade the third ventricle and cause internal hydrocephalus with dilatation of the lateral ventricles and typical defects in the shape of the third ventricle, which changes will be revealed by ventriculography. If the compression is below the third ventricle, the latter will be dilated. Subtentorial tumors also produce internal hydrocephalus. The mechanism of the increase in intracranial pressure is not completely cleared up even in tumors which cause a change in the circulation of the cerebrospinal fluid, but it would seem that hypersecretion of the fluid is the responsible factor. On the other hand, the importance of the venous pressure is demonstrated by Queckenstedt's test.

The absence of focal symptoms in many cases of cerebral lesion is explained by the presence of silent zones, but the fact is that the available methods of clinical investigation are still incapable of analyzing the delicate functions of the nervous centers. In addition, the most elementary physiological bases for the understanding of the nervous mechanisms of mental phenomena are lacking. The best material to study the neurological deficit in man is offered by lesions of the cerebral cortex in the rolandic region, and preferably in the precentral and postcentral convolutions, which give rise to motor disturbances ranging from more or less marked paresis to complete paralysis of the body segments. The motor disturbance involving an extremity is always greater in its distal parts, which seem to have an individual cortical representation. Sensitive disturbances are found when the lesion extends to both sides of the rolandic fissure, especially its posterior part (postcentral or ascending parietal convolution and neighboring parietal areas). The lesions which cause disturbances of speech may be found over a large area of the cortex of the left hemisphere and the extent of this area shows the complexity of the function of speech and the necessity of collaboration of a num-

ber of cortical zones possessing individual function (motor, sensitive, retentive, associative). Involvement of the central optic tracts by tumor may provide important focal signs: perimetric examination of the field of vision should never be neglected.

Epileptic phenomena were observed in 70 per cent of frontal and of parietal tumors, in 65 per cent of temporal tumors, and in 41 per cent of occipital tumors: they seem to depend on the localization and the nature of the tumor. The more benign gliomas have a greater tendency to cause epileptic symptoms than the malignant ones; this is due partly to the fact that the former show a predilection for the frontoparietal region and the latter for the temporal and occipital regions. In the present material there was no general relation between the increase in the intracranial pressure and the epileptic manifestations.

Clinical experience has shown that certain neurological syndromes are often associated with certain histological types of tumor. The syndrome due to neurinoma of the auditory nerve with gradual involvement of the neighboring nerves in the pontocerebellar angle allows diagnosis of the tumor, but in some cases it is necessary to eliminate other processes. Basal meningiomas of the anterior cranial fossa, of the lesser wing or of the more internal portion of the lesser wing of the sphenoid, and of the sella often present more or less definite syndromes. Other syndromes are associated with adenoma of the hypophysis.

False symptoms of localization of cerebral tumors are due to increase in the intracranial pressure and include before everything those of compression of the nerves on the borders of the dura mater or on cerebral vessels. The anatomical characters of the cranium play a great part in the production of certain symptoms and the foramina are sites of minor resistance through which cerebral hernias may occur: the tentorial fissure is a particularly vulnerable and important area.

The cerebral cortex is very sensitive to vascular changes as shown by animal experiments. It is possible that the vascular mechanisms, by compression of the Sylvian arteries, are partly responsible for the appearance of epileptic symptoms in the case of temporal tumors. In addition, tumors may cause local or general anemia of the brain by vascular compression, while an increase in the intracranial pressure impedes the circulation in the vessels of the cerebrum.

A fatal complication observed occasionally in patients with cerebral tumor is hemorrhage or vascular softening in the pons and the lower portion of the midbrain: the appearance of coma or of sudden loss of consciousness suggests hemorrhage in these parts.

RICHARD KEMEL, M.D.

Staffieri, D., Minnhaar, T. C., and Levit, L.: A Unilateral Paralytic Syndrome of Cranial Nerves in a Patient with Malignant Lymphogranuloma. (Sindrome paralítico unilateral global de los nervios craneales aparecido en una enferma portadora de un linfogranuloma maligno). *Rev. méd. d. Rosario*, 1941, 31: 485.

A twenty-nine-year-old woman with a malignant lymphogranuloma developed a unilateral paralytic syndrome of the cranial nerves, namely, a contraction of the right pupil, which did not react to light or accommodation, paralysis of the corresponding hypoglossus nerve, and hypo-esthesia of the right side of the face. The sensations of smell and taste were also diminished on the right side. The Wassermann reaction was negative.

The post-mortem examination disclosed a disseminated lymphogranulomatosis and a calcified papilloma of the chorioid plexuses. There also was a lymphogranulomatous tumefaction at the base of the skull which evidently was responsible for compression of the cranial nerves.

JOSEPH K. NARAT, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Wassersug, J. D.: Tuberculosis of the Sternum. *New England J. Med.*, 1941, 225: 445.

Twelve cases of tuberculosis of the sternum are reviewed.

They were about equally divided as to sex, 7 patients being females and 5 males. The ages of the patients at the onset of the symptoms varied from one and one-half to seventy years, and there was no preponderance of any age group. In no case was there a history of trauma. There was a definite history of contact with tuberculosis, however, in 5 cases.

Tuberculosis of the sternum must be suspected when a patient who has a tuberculous focus elsewhere in the body develops a swelling on the anterior chest wall in the region of the sternum. In most cases the swelling is painless.

Eventually, practically every case develops one or more draining sinuses, and in about a third of the cases the sinuses are multiple. Any portion of the sternum or its adjacent structures may be involved; hence the exact location of these sinuses is of no diagnostic significance.

Careful study of the material discharging from the sinuses or obtained at operation is essential for the correct diagnosis. This should be subjected to thorough pathological study, including guinea-pig inoculation.

Roentgen examination with the aid of contrast media injected into the sinuses may help in differentiating sternal tuberculosis from tuberculosis of the chest wall or ribs and costal cartilages. Tuberculosis may also involve the lymphatic vessels situated in the anterior costal interspaces, as well as the internal mammary or sternal lymph nodes, and necrotic nodes in this area may give rise to abscesses. In female patients, tuberculosis of the breast must occasionally be considered. The injection of a radiopaque substance under such circumstances readily gives the clue to the actual process. A negative tuberculin test helps to distinguish chronic nontuberculous osteomyelitis of the sternum from tuberculosis and is therefore of value. Syphilis can be identified by the Wassermann test and by the fact that syphilitic lesions usually heal rapidly with specific treatment. Sarcoma of the sternum may simulate tuberculosis roentgenographically, but since the sternum is readily accessible surgically, a biopsy specimen should be taken whenever there is the slightest doubt. Other tumors, such as cysts, lipomas, and fibromas, may also be ruled out by biopsy.

In the author's experience, the end-results of conservative treatment have been consistently good; radical surgery is apparently unnecessary.

SAMUEL H. KLEIN, M.D.

TRACHEA, LUNGS, AND PLEURA

Richards, L. G.: Vegetal Foreign Bodies in the Bronchi; An Analysis of 40 Cases. *Ann. Otol., Rhinol. & Laryngol.*, 1941, 50: 860.

One of the commonest groups of foreign bodies accidentally aspirated in the respiratory tract is that comprising various vegetable substances such as nuts, seeds, and fruit pits. Of these the nuts constitute an outstanding majority in the group of cases reported, peanuts alone making up 90 per cent of the total. Of late years there has been an ever-increasing popularity of confections in which are incorporated various forms of nuts. Inquiries into the stock of a group of stores reveal the fact that there are at least twelve forms of nut-containing candies in addition to the peanuts and other nuts sold in the natural state.

The age incidence in the present series of patients was from ten months to ten years, the average age being three and one-half years. Statistics of all forms of bronchial foreign bodies show a considerable number of patients under one year.

Only with attainment of the more advanced age period of from one to three years, when a more varied diet is in order, do misguided elders allow the baby a nibble of such unfamiliar dietary divergencies as a nut-containing candy bar or a few salted peanuts. Induced ofttimes by a crying, laughing, or coughing spell, a sudden inspiration draws a fragment or nut into the momentarily unguarded laryngeal orifice, and the damage is done.

The securing of a positive history of aspiration of a vegetal foreign body is of the utmost importance, since in these cases one often lacks the positive assistance afforded by the x-rays with opaque foreign bodies. If the event of aspiration, particularly in a child too young to describe the accident accurately, has passed unobserved by any adult, the ensuing signs and symptoms may for a time at least be so mild and insignificant as to be attributed to any one of a dozen less serious and more common conditions. It is therefore the duty of any physician to whom a child is referred for an unexplained cough, a slight but persistent fever, a transient pain in the chest or unusual lassitude or anorexia, at least to inquire into a possible history of aspiration. Failing a positive history, in the presence of signs and symptoms at all suspicious, a diagnostic bronchoscopy should be performed. A negative examination with all that it entails is far preferable to an erroneous diagnosis and the development of complications under the guise of chronic bronchitis or unresolved pneumonia.

The major responsibility rests with the parents first to call a physician in the event of anything suggesting aspiration of the foreign body. If this is done, and if the physician then accepts the story at its face value, there will be no appreciable number

of cases of delayed removal. It should be noted that in several of our series of cases, possible aspiration was at first denied, only to be acknowledged on more searching and repeated questioning.

On admission by far the greater number of patients showed no evidence of acute illness, only 1 case (No. 6) being classified as acute. While some fever was present in 16 of the 40 cases the average rectal temperature was only slightly over 100 degrees, the highest 104 degrees, and only 5 patients showed a fever up to 103 degrees. In these instances of higher temperatures the average duration of the presence of the foreign body was ten days, but there were numerous instances in which the object had been known to have been in the bronchus for a far more prolonged time with little or no febrile reaction. This brings up the important question of so-called arachidic bronchitis, a condition characterized by a violent febrile reaction and believed to be due to a peculiar response to certain toxic substances contained in nuts and certain other vegetal foreign bodies. This feature of these particular foreign bodies has been reported by numerous authors and has been made the subject of an experimental study by Heatly, who showed conclusively the irritative effect of certain extracted peanut oils on the lower respiratory tract of animals, which simulated quite closely the symptoms in infants and children who had aspirated nuts, corn kernels, peas, or similar substances. The authors were surprised and somewhat puzzled in reviewing these cases of aspirated vegetal foreign bodies to find an almost complete lack of this so-called arachidic bronchitis throughout the entire series. Even those cases manifesting a febrile reaction did not fit the clinical picture of the condition as commonly described by other authors. In only 1 instance did suggestive symptoms appear, but this was after and not before the extraction of the foreign body. In their experience, this same clinical picture has occurred much more frequently as the result of severe streptococcic infections of the upper respira tory tract than from a foreign body, and it is an open question if this infectious element may not be present in certain of the vegetal foreign-body cases reported as being the result of some inherent toxic substance in the foreign body itself.

The average pulse rate on admission in the present series of cases was 123. In only 1 case was a rate of 160 recorded.

Bearing more immediately on the question of bronchial obstruction and its clinical manifestations was the respiratory rate. One thinks naturally of a pronounced rise in this rate as a foregone conclusion in any case in which there is evidence of complete or partial obstruction of the entrance of air into one side of the lung. Nevertheless, the average respiratory admission rate in these 26 patients was only 33, the highest being 50, and yet, as will be shown later, practically all of these patients showed bronchial obstruction and were carrying out the oxygenation of their blood with a pulmonary area diminished by from one-half to one-fourth of the normal. The involvement of a similar area in a pneumonia would entail a respiratory rate of from 50 to 70, so that it is quite clear that the obstruction *per se* is not a particularly potent cause of dyspnea. Cyanosis, the final stage in respiratory obstruction, was positively recorded in only 3 instances. Its presence should never be awaited before concluding that bronchial obstruction exists.

Perhaps the one most constant and suggestive sign exhibited by this group of patients was cough. This was true in 29 of these cases. In about half of these the cough was harsh and brassy, in the remainder it was loose and moist. It was more apt to be of the latter type in patients in whom the nut had been present for a considerable period of time and in whom there was beginning to appear a purulent reaction with accumulated bronchial secretions.

Hoarseness was present in only 2 cases.

Second only to the obtaining of a positive or suspicious history of aspiration are the signs to be elicited by physical examination in cases of nuts or nut fragments in the upper air passages. For this reason a most careful examination of the lungs is of the greatest importance, together with an accurate interpretation of the findings, since otherwise definite signs may be most misleading and indicate a foreign body on the right side when it is actually on the left.

The three most common signs, so often associated together as almost to constitute a triad, are (1) unilateral limitation of expansion of the lung and chest on the affected side; (2) hyperresonance to percussion (so-called obstructive emphysema); and (3) absent or greatly diminished breath sounds. In the present series of 40 cases, the first of these signs was present 33 times; the second, 30; and the third, 35. All three of them depend primarily on a single physical fact, i.e., a partial obstruction to the ingress of air into the affected lung or part of the lung. Under these conditions, air will enter the lung past the foreign body at the time of inspiration, when the bronchial diameter is somewhat increased. On expiration, however, the bronchial wall contracts, and the foreign body or portion thereof acting in the nature of a valve prevents the egression of air. As a result, the so-called obstructive emphysema is produced, to which attention of late has frequently been called by numerous authors. A lung or its lobe gradually inflated in this manner would produce all three elements of the mentioned triad.

The signs just described are those that supervene almost immediately after inhalation of the foreign body. As time goes on and obstruction becomes more and more complete, due to the swelling of the bronchial mucosa around the foreign body, the ball-valve action ceases and air can neither enter or leave the lung. Gradually the air is absorbed, and there then ensues a different picture with the clinical signs of atelectasis.

Bronchial breathing appeared only four times and was not due, as other authors have pointed out, to a true pneumonic consolidation. The latter is extremely rare in connection with vegetal foreign

bodies, and the signs suggestive of it are far more frequently due to some compression of a lobe that is adjacent to an area involved in obstructive emphysema.

It is interesting to note that râles were recorded in these cases on only 9 occasions. They were indicative of some suppuration, or more frequently of a foreign body loose in the trachea. Various combinations of these typical signs may be encountered.

It is interesting to note that there was an equal distribution of the foreign bodies in the right and left bronchus.

While the roentgen-ray examination of cases of non-opaque foreign bodies in the lung must necessarily be far less conclusive than in the case of metallic objects, nevertheless, with certain technical refinements and the appreciation of detail developed in the past few years much valuable information can be obtained. Chief among these advances has been the taking of two films, one as nearly as possible at the end of expiration and one at the end of inspiration. This is not always easy or even possible in an unco-operative or crying child, but it affords an opportunity to bring out by means of the x-rays one of the most important diagnostic features exhibited by such bronchial foreign bodies as nuts, that is, obstructive emphysema.

On full inspiration, with air entering both sides of the chest, there will be the normal appearance of bilateral hyperaeration. At the end of expiration, however, a distinct variation is noted. The normal deflated lung will show a slightly diminished density as compared with the abnormal or obstructed side, which by reason of imprisoned air will show the same hyperaeration as is seen in both lungs at the end of inspiration. The situation, if not clearly understood, may lead to a totally erroneous opinion as to the location of the foreign body as one would be inclined to regard the more completely aerated lung (at the end of expiration) as the normal one, whereas in reality it is the obstructed one.

If now such changes have occurred in the lung as a result of a more prolonged sojourn of the foreign body in the bronchus and emphysema has been replaced by atelectasis, then a different picture obtains. At the end of inspiration, only the normal lung is aerated, while at the end of expiration both sides show a diminished radiability, more marked on the affected side. Practically never is any shadow cast by the vegetal foreign body itself visible.

Additional information is to be obtained from fluoroscopic examination of the chest. Here a typical obstructive emphysema will show a limitation of motion of the diaphragm on the affected side, and a displacement to the affected side will be seen in the case of atelectasis.

In those cases in which the foreign body is too large to engage in the bronchial orifice it must remain loose in the trachea. In these cases there will, of course, be no x-ray signs of unilateral obstruction and the roentgenologist cannot be expected to confirm any diagnosis of foreign body.

In the present series under review there is recorded a positive roentgenological finding of foreign body in 17 cases and a negative one in 5.

In the present series of cases in which nuts were removed from the respiratory tract, avertin given by rectum was used in 13 bronchoscopies on 11 patients. The dose varied from 80 to 100 mgm. per kilogram of body weight. That its use lessens the strain on both the operator and the patient cannot be denied, although it may still be criticized with some validity.

Technical difficulties. Foreign bodies such as nuts do not, of course, present the problem so often encountered in dealing with pointed objects such as nails and tacks, and removal *per se* is not likely to do any damage to the bronchial wall. What may best be called "fragmentation" is perhaps the greatest obstacle encountered in the removal of nuts. There is a tendency for such objects to break by cracking when grasped with the forceps, and the longer their presence in the bronchus and their contact with the bronchial secretions, the greater is this tendency toward fragmentation. Attempts to grasp the object delicately may mean an insecure hold, while more forcible application of the forceps may break a large nut fragment into several smaller ones. The dangers of this situation are quite obvious. If the portion held by the forceps is retained and removed, there is the possibility that a smaller piece may yet remain behind unknown to the operator unless subsequent symptoms indicate that removal was not complete. This is the more likely since the smaller fragments may easily descend to a lower position in the bronchial tract, at a level too low to permit visualization through the bronchoscope. Occasionally such smaller fragments may be coughed up spontaneously, but one can hardly rely on this fortunate accident with any confidence. What is far more hazardous is the possibility that a relatively large fragment may be broken off and aspirated into the previously unobstructed bronchus, in which case, if the originally affected side be in any degree occluded by inflammatory reaction, there will occur a bilateral obstruction with asphyxia, calling for immediate removal of the loose secondary fragment, if death is to be avoided. Such was the situation in 1 instance in which only prompt retrieving of the fragment of a peanut from the opposite lung saved the patient from asphyxiation. This unpleasant situation is most likely to arise when the original foreign body is in the trachea and so large as to prevent its entrance into either bronchus. If fragmentation then ensues in the process of removal, smaller but still good sized pieces may then easily occlude both bronchi almost simultaneously.

To check up on this situation and to avoid so far as possible the leaving of unremoved foreign bodies in the lung, the author has made it a practice to auscultate the lungs before the termination of bronchoscopy. If the quality of the breath sounds in any way suggests gross failure of the air to enter one side of the chest, further search is immediately made for

another portion of the foreign body. This plan is based on the fact that in most instances, except after prolonged sojourn, an occluded lung will resume its function almost immediately after removal of the obstructing foreign body, at least to such an extent as to make further gross obstruction quite obvious with the stethoscope. In this way, it may be possible to avoid the necessity of a secondary bronchoscopy at some later date. A review of his cases reveals the fact that in 20 instances the foreign body was removed in a single unit and in 15, as two or more fragments. Multiple bronchoscopic examinations were necessary in 7 of his cases. In 2 of them this was the result of failure at the first or second examination to locate any foreign body. It is surprising how such an examination, though carefully carried out, may at imes fail to reveal a foreign body which on a subsequent bronchoscopy is at once quite obvious. Some slight change in position or alteration in local reaction usually accounts for this. In any event, it is a safe conclusion that when history or physical findings strongly point to the presence of a foreign body, failure to observe it bronchoscopically on one or even two examinations does not guarantee its absence, and further search should be made. So long as these examinations are reasonably spaced, such multiple bronchoscopies do not harm the patient in any way, and are quite likely in the end to yield success.

Such conditions as laryngeal edema, evidence of residual fragments, or unexplainable febrile reaction with or without signs of pulmonary involvement not previously present must be regarded as true complications and hence indicative of a situation which requires explanation and perhaps additional therapeutic measures.

In 12 cases there was absolutely no postoperative symptomatology. In 13 cases, there was a record of some symptomatology, such as fever, brassy cough, purulent expectoration, or physical signs of pulmonary involvement, all of which, however, subsided or disappeared spontaneously without requiring any further bronchoscopic or surgical procedure.

In 11 cases there was a record of symptoms plainly indicative of an unremoved fragment of foreign body. In 3 of these, there was a prompt subsidence of these symptoms following secondary removal of the remnant, and in a fourth the patient coughed up the remnant spontaneously. In 1 case three bronchoscopies were required for successful removal because at the first two examinations no foreign body could be seen. In 4 instances, it was necessary to carry out further procedures for postoperative laryngeal obstruction. In 1 of these direct intubation was carried out with only temporary relief. Tracheotomy was next resorted to, following which there developed typical signs of low tracheobronchial infection, with the production of inspissated crusted secretions which required bronchoscopic removal on four occasions.

There was 1 death in the series. The patient had previously been treated elsewhere as having pneumonia, and only after further scrutiny into the history five weeks later was the suspicion of inhalation of a peanut elicited. Bronchoscopy was performed without anesthesia, the child suddenly ceased to breathe, and no heart sounds could be heard. Autopsy was refused. GEORGE A. COLLETT, M.D.

Ceballos, A.: A One-Stage Operation for the Removal of Hydatid Cysts from the Lung Which Is Free from Pleural Adhesions (Operación en un tiempo de los quistes hidáticos de pulmón libres de adherencias pleurales). *Bol. y trab. Acad. argent. de cirug.*, 1941, 25: 888.

The author reports on 22 cases of hydatid cysts of the lung which he treated by a one-stage operation. He emphasizes that this method is suitable only when there are no pleural adhesions. The first requisite is accurate localization of the cysts. The anesthesia is administered through a tracheal intubation tube under pressure, which forces the lung tissue against the surgical wound and thus prevents a secondary pneumothorax with subsequent contamination of the pleural cavity with pus from the hydatid cysts.

The incision is made as for an ordinary rib resection and the rib over the involved area is resected. The parietal pleura is incised and a needle is inserted into the presenting lung tissue to aspirate and to determine the relative thickness of the pericystic wall. The cyst is aspirated and the germinative membrane removed. A gauze pack is introduced into the cystic cavity and the cyst is marsupialized by suturing its walls to the intercostal muscles and the lips of the surgical wound. No unfavorable reactions have been observed from this procedure. One patient died of bronchopneumonia and abscess of the lung.

This one-stage operation shortens the stay in the hospital to an average of thirty-two days. Contamination of the pleura is avoided and consequently the tedious secondary drainage is unnecessary. There are brief clinical reports on the 22 cases, and a complete discussion of the subject by professional colleagues of the Argentine Academy of Surgery. JACOB E. KLEIN, M.D.

HEART AND PERICARDIUM

Furtado Disa, M. T.: Tumors of the Heart (Tumores do coração). *Arq. de patol.*, 1941, 13: 57.

In 1900 Seiffert was able to collect only 9 cases of primary tumor of the heart. In 1937 Clerici reported 151 cases, of which 58 per cent were benign and 42 per cent malignant. Among the benign tumors 20 per cent were rhabdomyomas, 16 per cent myxomas, 15.5 per cent fibromas, and 5.35 per cent lipomas. Among the malignant tumors 23 per cent were sarcomas. The rarity of tumors of the heart has been attributed to the high degree of differentiation of the heart-muscle cells. It is possible that the tumors that occur develop from subendocardial remnants of embryonic tissue.

In 1916, 165 cases of tumor of the heart had been reported in animals. Strangely enough, in guinea pigs which are used so much as laboratory animals, only 2 cases of tumor of the heart have been reported, the first by Bender in 1925 in the *Journal of Medical Research*. This was the case on which this article is based; it was seen in 1937 in the Portuguese Institute of Oncology. A series of animals had been given injections into the brain of a solution of methylcholanthrene in peanut oil. One of them began to lose weight after three months and was killed for autopsy. The brain was congested and the hypophysis enlarged. A grayish tumor the size of a hazelnut filled the enlarged auricles of the heart, the walls of which were thin. A detailed description of the cells of this tumor is given and illustrated with photomicrographs. It was a myoblastic sarcoma. These tumors are sometimes mistakenly diagnosed as spindle-cell sarcomas. The characteristic spider-web cells of Seiffert showed that this tumor originated in the heart muscle.

Myosarcomas of the heart are generally considered congenital in origin. The one observed developed after the injection of a cancer-producing substance, as did the tumor in Bender's case, although the name of the substance was not given in the description. It is possible that the drug acting on embryonic rests produced the tumor. This would explain the development of a tumor at a distance from the site of the injection.

AUDREY G. MORGAN, M.D.

ESOPHAGUS AND MEDIASTINUM

Gray, H. K., and Sharpe, W. S.: Benign Lesions at the Lower End of the Esophagus. *Am. J. Surg.*, 1941, 54: 252.

Achalasia and cardiospasm are two of the most commonly used terms referring to dilatation and hypertrophy of the esophagus and spasm of the musculature of the cardia. Passage of food normally from the esophagus to the stomach is partially or completely blocked; yet in most instances no true mechanical obstruction can be demonstrated.

In only 7 of 1,200 cases of cardiospasm encountered at the Mayo Clinic, surgical treatment was necessary. Moersch, in 1933, reported 810 cases from the same clinic, 805 having been treated conservatively, by dilatation from above. Seventy-one per cent of the 670 patients traced were well. If the dilatation of the esophagus is sigmoid-shaped, as noted by Lambert, surgical treatment may be necessary in order to obtain relief. Esophagogastrostomy seems the most rational operation and in the hands of experienced operators gives good results. The transperitoneal route has been found to be preferable to the transpleural route and should be used in most instances. More than 90 per cent of the patients in the collected cases report good results from esophagogastrostomy.

Diverticula of the esophagus in various portions of its length are fairly common. They are best classified by their anatomical position and may be divided broadly into three groups: (1) the pharyngoesophageal, (2) the epibronchial, and (3) the epiphrenal or supradiaphragmatic. These may be either true diverticula or false, the differentiation depending on whether there is protrusion of all coats of the esophagus or merely herniation of the mucous membrane with its submucous coat. The location of the sac usually makes conservative treatment imperative. Often treatment by occasional lavage from above in mild cases is sufficient. Dilatation of the esophagus with bougies is attended with success, especially if there is attendant cardiospasm.

Esophageal varices depend for their development both on the obstruction of the portal and lienal veins and on the poor support rendered by the loose connective tissue of the submucosa of the esophagus. The inherent dangers of such varices lie in their tendency to bleed and their inaccessibility for treatment. Treatment of the varices may be either conservative or surgical. Conservative measures of treatment imply protection of the varices from trauma by means of a bland, non-irritating diet, while one attacks the underlying cause. It would seem that the most promising treatment, the value of which is still undetermined, is the injection of the varices by means of the esophagoscope, in conjunction with an attempt to bring the underlying cause under control. The combination of such esophagoscopic treatment with splenectomy seems to offer the best chance of avoiding fatal hemorrhage.

Benign discrete ulcers of the esophagus have a predilection for the lower third of the esophagus and may often be confused with gastric disease. The treatment cannot be specific. The general condition of the patient must be improved and the sources of infection in the mouth and throat removed. A trial of medical management similar to that for peptic ulcer must be instituted. Application directly through the esophagoscope of a 10 per cent solution of silver nitrate or chlorlyptus oil has been recommended by Patterson. Often the cardiospasm and stenosis will be benefited by dilatation from above by bougies.

Other esophageal lesions also were considered in the paper.

Holinger, P. H.: Complications of Esophageal Perforations. *Ann. Otol., Rhinol. & Laryngol.*, 1941, 50: 681.

The esophagus is surrounded by loose connective tissue which is very susceptible to infection. The esophagus is also a fragile organ and easily perforated. Perforation of the esophagus may be due to neoplastic disease, trauma (particularly that of foreign bodies or the instrumentation for removal of foreign bodies), the ingestion of caustics, or the attempt to dilate strictures, and rarely to external trauma.

The usual symptoms are pain and tenderness which increase with swallowing—these may be associated with emphysema extending into the neck, rapid pulse, high temperature, evident shock, and

dyspnea. Physical signs and roentgen studies give evidence of a widening of the mediastinal shadows, and lateral roentgenograms reveal a thickening of the postlaryngeal and post-tracheal shadows. Perforation into the pleura results in a pyopneumothorax, and perforation into the trachea results in severe attacks of coughing and expectoration of all swallowed foods and fluids. Hematemesis results from perforations into great vessels.

Treatment in cases with mild symptoms should be conservative—rest to the esophagus, chemotherapy, and feeding through the veins or by a small Levine tube. In cases of severe infection, cervical mediastinotomy or posterior mediastinotomy should be performed. Feeding can be carried on by means of gastrostomy. JULIAN A. MOORE, M.D.

MISCELLANEOUS

Nosworthy, M. D.: Anesthesia in Chest Surgery, with Special Reference to Controlled Respiration and Cyclopropane. *Proc. Roy. Soc. Med.*, Lond., 1941, 34: 479.

Patients undergoing surgery on the thorax present numerous problems to the anesthetist. These include chronic invalidism, toxemia, and amyloidosis, sputum or blood in the tracheobronchial tree with its attendant danger of spread, low vital capacity and restricted ventilation due to position on the operating table, as well as loss of body heat through the large wound. A prompt return of reflexes is desired. Paradoxical respiration and improper ventilation as a result of open thoracotomy with and without mediastinal fixation, extensive rib resections, and "stove in chest" are discussed.

The special duties of the anesthetist are given as (1) circulatory resuscitation, including intravenous therapy during operation, and (2) maintenance of efficient respiration. Positive pressure anesthesia is not believed to be entirely satisfactory, "controlled respiration" being preferred because it abolishes the dangers of open pneumothorax; permits full use of the patient's vital capacity; efficient oxygen supply and carbon-dioxide absorption are secured; the tracheobronchial secretions may be easily aspirated; and respiratory movements may be arrested to facilitate the performance of delicate maneuvers by the surgeon.

Controlled respiration means that the anesthetist, having abolished the patient's active respiratory efforts, maintains an efficient, rhythmic, tidal exchange of gases. This may be done by the Crafoord-Frenckner spiropulsator or by hand, which is the author's method of squeezing the breathing bag.

Active respiration can be stopped by (1) lowering the patient's carbon-dioxide level by hyperventilation, (2) depressing the respiratory center by drugs, and (3) combinations of 1 and 2. Once this state of apnea is obtained it is maintained by using a carbon-dioxide absorption technique. The fine adjustments required and the details of management are discussed at length. Various anesthetic agents may be used in this method but the author prefers cyclopropane. Pantopon, scopolomine and often also sodium pentothal (intravenously) are given, followed by a rapid cyclopropane induction. Attention is called to the gradients of gas concentrations in lung, blood, brain, and tissues which require time to establish a uniform level, the reversal of this process taking place at the termination of the procedure.

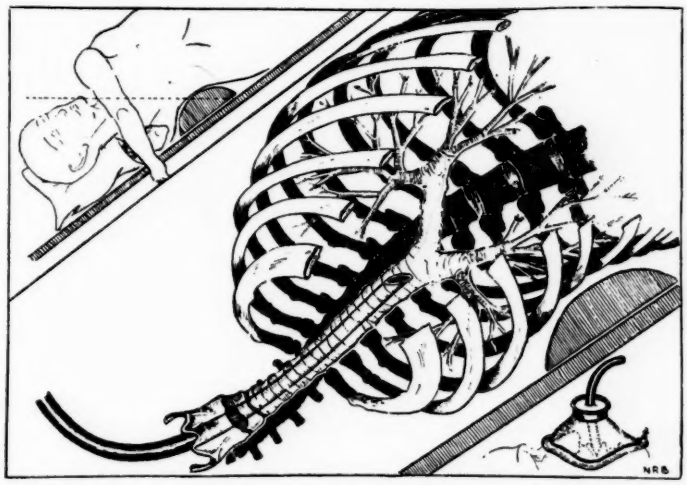

Fig. 1. Degree of Trendelenburg necessary to prevent secretion from left lung running into right bronchial tree. When the endotracheal tube is not fitted with a balloon, sputum will not be dammed back near the carina.

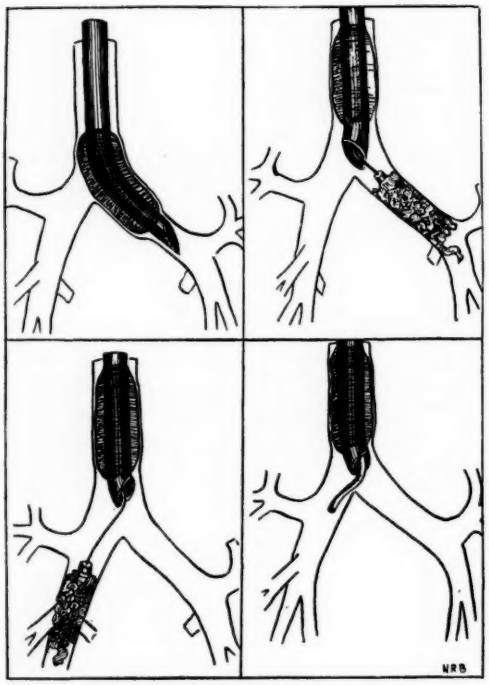

Fig. 2. a, A left endobronchial intubation with balloon occluding orifice of the right main bronchus. b, Left bronchus blocked by ribbon gauze packing kept in place by wire rod over which an endotracheal catheter is threaded (for left pneumonectomy—Crafoord). c, Crafoord's technique for right lower lobectomy leaving upper lobe bronchus patent. d, Destination of tip of suction catheter uncertain when passed down endotracheal catheter.

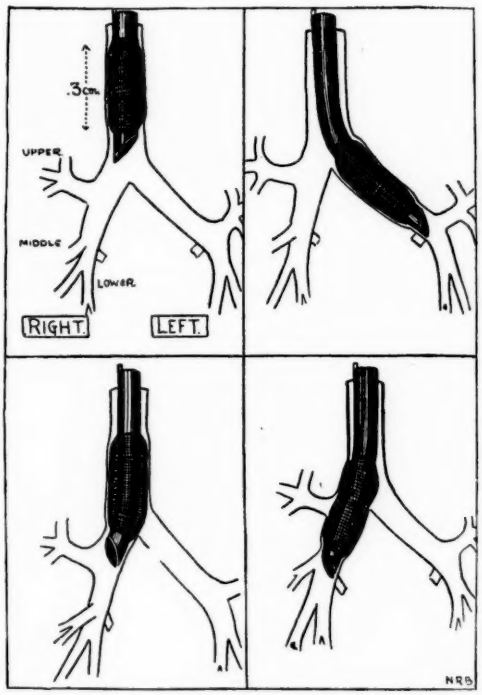

Fig. 3. a, Balloon endotracheal catheter in place. b, Perfect left endobronchial intubation—ideal for right pneumonectomy (compare with a). c, Right endobronchial intubation with balloon occluding orifice of the left main bronchus. d, Right endobronchial intubation with balloon occluding right upper lobe bronchus.

The uses, advantages, and disadvantages of local, spinal, rectal, and intravenous anesthesia in thoracic surgery are discussed. The inhalation anesthetics are reviewed and the problem of cardiac arrythmias under cyclopropane is elaborated.

The pharyngeal airway often is sufficient but laryngeal intubation is advised in the presence of abundant secretions, which may require suctioning. Selective tracheobronchial intubation for anesthesia and tamponade to prevent overflow of the secretions is illustrated. The special technical problems presented by pneumonectomy, lobectomy, and bronchopleural fistula with a review of some recent war casualties are presented. H. T. LANGSTON, M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Arnheim, E. E., and Neuhof, H.: The Treatment of Inguinal Hernia by Injections under Operative Visualization. *Surgery*, 1941, 10: 624.

In order to evaluate the injection method of treatment of various types of inguinal hernia, the authors devised an operative visualization method in which the injection could be made precisely into the properitoneal tissues over the dome of the sac and between the transversalis fascia and the adjacent sac. By this method there could be no question as to the injection being properly made, and therefore a proper evaluation of the method could be ascertained. The operative method consisted in making an inguinal incision under local anesthesia. The aponeurosis of the external oblique muscle was usually split and, with the hernia thereby exposed, from 20 to 50 c.c. of a 5 per cent solution of sylnasol (an irritant extracted from psyllium seed) was injected in the area described above. The aponeurosis and skin were then closed with sutures.

Postoperatively the patients were kept in bed approximately a week, and before being allowed up were fitted with trusses which were to be worn for one year. After the injection, the tissues immediately showed a bluish discoloration. There was mild fever in all cases for three or four days, and in some serum collections and wound infections developed.

Although the injections of sylnasol were made accurately and precisely, results were not good in the relatively small number of patients so treated.

Sixteen cases of direct inguinal hernia, treated with the operative visualization injection method, were followed up for more than a year. In this group there were 9 cures and 7 recurrences—a 43.7 per cent recurrence rate. Patients without recurrences were followed up for an average of two and one-half years.

Three patients with recurrent direct inguinal hernias were treated. Of these, 2 developed recurrences.

In 5 patients with combined indirect and direct inguinal hernias, a surgical excision of the indirect sac was combined with injection of the direct hernia and surgical repair of the inguinal canals. Four patients were well, the fifth developed a recurrence. Two patients with recurrent direct hernia were treated with the combined hernioplasty and injection method. One developed a recurrence.

Experiments were performed in dogs by injecting psyllium-seed extracts into the muscles and fascia of the back, and histological sections were made at intervals up to six months. At four months dense fibrosis was noted, but after six months the fibrosis became broken down into bundles separated by fat, which indicated that the fibrosis was not permanent. Operations performed for the repair of recurrent hernia after the injection treatment in human beings showed little fibrosis in the inguinal canal.

The injection method, in the opinion of the authors, is too uncertain in results to be advocated as a dependable therapeutic procedure.

LUTHER H. WOLFF, M.D.

GASTRO-INTESTINAL TRACT

Swalm, W. A., and Morrison, L. M.: Gastroscopic and Histological Studies of the Stomach with Gastric and Extragastric Disease During Life and at Autopsy. *Am. J. Digest. Dis.*, 1941, 8: 391.

A study of 40 autopsies and gastroscopic biopsy cases was made in an attempt to understand better the underlying pathology existing in gastritis. Histological criteria for the "normal stomach" and the grades of gastritis utilized in this study are presented and illustrated with photomicrographs. These criteria are as follows:

Normal stomach. The mucosa is rather thick, varying from 0.5 mm. at the cardiac end to from 1 to 2 mm. at the pylorus. The glands are lined by columnar epithelium. They are of simple tubular variety in the fundus and become branched as the pylorus is approached. The cells rest upon a basement membrane which, in turn, rests upon the tunica propria. Between the glands, the tunica propria consists of narrow bands of fibrous connective tissue which contains lymphoid tissue and blood vessels. The submucous coat consists of areolar tissue. The muscular coat consists of 3 layers, the inner is oblique, the middle is circular, and the outer is longitudinal. In some stomachs with no clinical symptoms, a sparse, plasma-cell infiltration may occur in the interstitial tissue. This may be called borderline, as the authors interpret it as questionable, or as a gastritis (plus-minus).

Chronic gastritis.

(a) Superficial (catarrhal), in which the inflammatory reaction is confined to the mucosa. The interstitial tissue shows infiltration by inflammatory cells, the majority of which are plasma cells and lymphocytes, although a few eosinophils may be present. There may be congestion, edema, and fibrocytic or fibroblastic proliferation. The inflammation does not involve the deeper layers. This may be the early stage of either the atrophic or hypertrophic type.

(b) Hypertrophic, in which the mucous membrane undergoes marked thickening. The mucosal cells show a hypertrophic and hyperplastic reaction, and the submucosa reveals an increased connective tissue. At times, there is a diffuse chronic inflammatory mononuclear cellular infiltration which may approach a picture which is so extreme as to be called polypoid gastritis.

(c) Atrophic, in which the reverse of the foregoing is found. The mucosa is markedly thinned. Few glands are identified. The submucosa is thinned, fibrosed, and is apt to show chronic inflammatory

cellular reaction with a rather prominent number of eosinophils. The muscle fibers are atrophic and there is some diffuse fibrosis. This atrophic picture may follow the initial hypertrophic type as an exhaustion picture.

Chronic gastritis may be graded as follows:

A. Chronic gastritis (plus-minus), in which there is questionable evidence of inflammation. There is a moderate degree or some sparse plasma-cell infiltration of the interstitial tissue.

B. Chronic gastritis Grade I, with definite evidence of inflammation. There is a mild, diffuse, inflammatory cellular infiltration of the mucosa with, perhaps, edema and congestion.

C. Chronic gastritis Grade II, with moderate inflammatory cellular infiltration, edema, and congestion as in B. There may be hemorrhages, erosions, or ulcerations. The submucosa may be involved and it may be of the atrophic or hypertrophic type.

D. Chronic gastritis Grade III, with a marked picture as compared with Grade II.

The following are the authors' conclusions:

1. In 15 cases the stomachs of adults and infants were fixed by immediate autopsy or intubation at death for the evaluation of so-called normals in extragastric disease. Six of the 15 proved normal histologically, and 3 of these were those of adults from twenty-six to forty-three years of age.

2. Nine of this group showed gastritis, subacute or chronic, and again revealed that histological chronic gastritis does not run parallel with clinical gastrointestinal symptoms.

3. Detailed data, with illustrative charts, on 25 cases, in which gastroscopic studies, followed shortly by biopsied specimens taken through the open-tube gastroscope, were compared with subsequent histological findings. In no case was operation or resection performed.

4. (a) The histological diagnosis agreed with the gastroscopic diagnosis in "normal" stomachs or in gastritis is in 52 per cent of the cases; (b) the histological diagnosis disagreed with the gastroscopic diagnosis in "normal" stomachs or in gastritis in 24 per cent of cases; and (c) the histologic diagnosis gave questionable findings in 24 per cent of the cases diagnosed gastroscopically as gastritis or "normal."

5. (a) The gastroscopic appearance of a severe gastritis is usually verified by the histological examination; (b) the gastroscopic appearance of a mild or moderate degree of gastritis or normal stomach may be contradicted upon histological examination; (c) a normal stomach according to the gastroscope may be gastritis histologically, and *vice versa*, unless a marked, or Grade III or IV gastritis is seen gastroscopically. SAMUEL H. KLEIN, M.D.

Allen, A. W., and Welch, C. E.: Gastric Ulcer. *Ann. Surg.*, 1941, 114: 498.

Gastric and duodenal ulcers have been discussed so frequently under the general heading of "peptic ulcer" that a serious confusion has resulted regarding the proper management of these two distinct entities. Early symptoms in both diseases are much alike and the conservative measures, found adequate in uncomplicated duodenal ulcer, will also be temporarily effective for gastric ulcer. The greater frequency of acute duodenal lesions, compared to those of the stomach, has enhanced the standardization of the treatment of duodenal ulcer. This regimen applied to the more rare gastric ulcer has often proved disastrous. Gastric ulcer is, fundamentally, a surgical lesion. This is the direct antithesis of our present concept regarding duodenal ulcer.

Gastric ulcer cannot be distinguished from cancer in a high percentage of cases. The authors' study deals with 277 patients whose original diagnosis was gastric ulcer. Thirty-nine of them, or 14 per cent, finally proved to have cancer. Seventeen with a pre-operative diagnosis of cancer proved to have benign ulcer.

The gastric cancers that simulate gastric ulcer comprise an especially favorable group for cure. On this basis alone, surgery should be the treatment of choice. The end-results of gastric resection for ulcer seem to substantiate this same form of treatment even if the ulcer is proved to be benign.

It may be expected that patients complaining of indigestion, hyperacidity, and gaseous eructations for the first time after the age of fifty would have cancer rather than ulcer. This is an important diagnostic point, since patients beyond the fifth decade with a gastric ulceration causing symptoms of less than one year, are more than five times as likely to have cancer instead of ulcer. On the other hand, those patients with symptoms of five or more years had a reverse ratio with regard to ulcer and cancer.

The authors recommend immediate surgery for any one of the following indications:

1. An ulcer of short duration if the patient is more than fifty years of age.
2. An ulcer more than 2.5 cm. in diameter.
3. If there is no free hydrochloric acid in the stomach.
4. An ulcer in the greater curvature or in the prepyloric region.
5. A chronic ulcer on the lesser curvature.

The authors recommend hospital observation and treatment for one month if (1) the ulcer is acute and in a young patient, (2) the ulcer is under 1 cm. in diameter, and (3) the ulcer is on the lesser curvature or the anterior or posterior wall.

If healing is complete in one month, repeat observations should be made one month after discharge from the hospital.

If healing is not complete in one month, by roentgenological and gastroscopic examinations, then surgery is advisable. JOSEPH K. NARAT, M.D.

Emery, E. S., Jr.: A Comparison of the Meulengracht and Sippy Therapies in the Care of Bleeding Peptic Ulcers. *Am. J. Digest. Dis.*, 1941, 8: 387.

For fifteen years prior to January 1, 1940, bleeding ulcers were treated at the Peter Bent Brigham Hos-

pital, Boston, by complete alkalinization as recommended by Sippy. In this routine, patients were started with hourly doses of 4 gm. of calcium carbonate, or 2 gm., doses of magnesium oxide throughout a period of twenty-four hours for two or three days and were then placed on a regular Sippy regimen. For hypersecretion, or if continuous secretion was suspected, the powders were continued throughout the night for an additional two or three days after food was started. In the milder cases of this condition, the milk feedings might be started from the beginning.

During the fifteen years in which this regimen was utilized, 450 patients with hematemesis or melena had a mortality of 6 per cent. This type of Sippy routine differs from the usual starvation routine in two important respects: the gastric contents are neutralized and "something" is introduced continuously into the stomach, and, as a rule, food is permitted somewhat sooner than in the starvation methods of treatment. For this reason the method employed is more like the therapy recommended by Meulengracht than that which he himself was using before he started feeding his patients.

In January, 1940, Emery began treating all of his patients with bleeding ulcer with the same diet outlined by Meulengracht. Exactly the same foods, and the same kinds of alkalies and belladonna were given; only iron was eliminated.

This report is based upon 36 cases treated since April 1, 1941. These cases were compared with a control group of 50 cases which had been treated by the Sippy regimen during the years 1932 and 1933. The types of patients in both groups were very similar. The sex incidence, age of the patients, duration of the ulcer, incidence of previous hemorrhage, cell counts, and the severity of symptomatology were all essentially the same.

The final conclusion was that the results of the Meulengracht regimen closely approximated the results obtained by the Sippy method in so far as could be determined from this small series of cases. The first method surpasses that of Sippy only in being more pleasant for the patient and in that his strength is more satisfactorily maintained. There was no evidence to indicate that bleeding had stopped more quickly with the Meulengracht routine, or that the extra food had increased the rate of blood regeneration.

In the discussion of his paper, Emery states that his present belief is that a definite decrease in the rate of mortality at the Peter Bent Brigham Hospital will come only by earlier and more accurate determination of which patients need surgery to stop their bleeding. In addition, he has found that patients maintain their strength and appear to be better in general with the Meulengracht routine. For this reason, and because he has observed no increase in mortality over the figures obtained with the Sippy routine, he is continuing to feed his patients as recommended by Meulengracht.

SAMUEL J. FOGELSON, M.D.

Ireland, J.: The Treatment of Intussusception. *Arch. Surg.*, 1941, 43: 418.

In a discussion of the 133 cases of intussusception admitted to Children's Memorial Hospital, Chicago, from 1920 to 1939, some of the procedures used in these cases are described, including a method of the author's. These methods include:

1. Enemas. These were given to 64 of the 133 patients and brought about reduction in only 11 cases, contrasted with successful reduction in 60 per cent of the series of 300 cases reported by Hipsley in 1936.

2. Farr's method. This method was used in the operative cases in this series, with good results in 92 (83 per cent) of the 100 cases in which it was tried. In this procedure, a rubber catheter with attached blood-pressure bulb is inserted into the rectum before anesthesia is begun. When the abdomen is opened and the intussusception located, the bowel is inflated through the rectal catheter under guidance of the operator's hand and manipulation is begun. Inflation alone usually causes a partial reduction and has effected complete reduction in some instances.

3. Montgomery and Mussil's method leaves the unreducible bowel in place, and the intussuscipiens is sutured to the intussusceptum; after this a side-to-side anastomosis of the bowel is made. Of the 18 patients in this series, in whom some operative procedure was performed on the bowel itself, 14 (78 per cent) died.

4. The author's method. The failure in reduction is ascribed to the fact that the inflamed and roughened bowel serosa causes the two opposing surfaces to adhere to one another. It was suggested that a lubricant introduced between the intussuscipiens and the intussusceptum would obviate this difficulty. Glycerin was used because it would least damage the bowel and because its hygroscopic property would help remove some of the edema fluid from the inflamed wall. Two cases are reported in which this method was successful after the Farr method had failed. From 5 to 10 cc. of glycerin were injected between the intussuscipiens and the intussusceptum with a 2 cc. syringe; the neck was then grasped with the thumb and forefinger of the left hand, while the forefinger of the right hand was introduced through the neck and used to sweep the glycerin around from one mesenteric border to the other as further attempts were made at disinvagination. After reduction was gained, as much as possible of the glycerin was removed with a sponge.

EUGENE J. AUDI, M.D.

Goligher, J. C.: The Operability of Carcinoma of the Rectum. *Brit. M. J.*, 1941, 2: 393.

This study of the operability of rectal cancer at St. Mark's Hospital, London, is based on 1,186 cases seen at this institution in the ten-year period from 1930 to 1939.

The operability rate for males was 58.5 per cent, for females 64.5 per cent, and for both sexes 60.3 per cent. Although the prospect of ultimate cure was

naturally less in some cases than in others, no case was considered operable unless there appeared at the time of the operation some chance of complete cure. These figures do not include those patients in whom excision was performed but whose growths were known not to have been removed completely, as, for example, when a small secondary nodule was present in the liver. Such cases were grouped as palliative excisions in "inoperable" cases.

Inoperability was determined either by an unsatisfactory general condition of the patient, or by an advanced state of the growth which placed it beyond the reach of surgery. Only 8 per cent of the patients were considered inoperable because of a debilitated state. This is important because the majority of the patients suffering from carcinoma of the rectum are elderly, and often their general condition has been undermined before they present themselves for treatment. Some conditions which contraindicated surgery were cardiac disease, chronic bronchitis, emphysema, pulmonary tuberculosis, an unstable mental condition, and diabetes mellitus. Operability was greatest between the ages of forty and forty-nine, and declined in patients older or younger than this, but even in the age group between seventy and seventy-nine operability was still about 50 per cent.

In 32 per cent of the cases, inoperability was due to the advanced state of the growth. Operability of the carcinoma itself was determined by the presence of local fixation of the growth, hepatic metastases, peritoneal carcinomatous plaques, or extensive involvement of the abdominal lymph glands. Laparotomy was usually necessary before a decision could be reached as to the existence of these contraindications.

Local fixity of the growth was found in 23.9 per cent of the generally operable cases and in 18.9 per cent of the cases in which laparotomy was performed. Growths involving the anterior wall of the rectum were much less frequently operable than those confined to the other quadrants of the bowel. The operability of anterior growths in women was higher than in men. The adhesions producing fixation were usually, but not invariably, inflammatory.

Hepatic metastases were palpable in 11.5 per cent of the cases which were operated upon. The presence of concealed undetected metastases was postulated in another 14.3 per cent of these cases. The significance of these buried metastases is that many patients are subjected to so-called radical excisions when the disease extends beyond the scope of such operations and involves the liver.

A higher operability rate can be obtained by having available several radical procedures of varying severity. The method of choice is usually an abdominoperineal or perineo-abdominal operation.

The operative mortality for all surgically treated cases was 15.6 per cent, for cases submitted to combined excision 18.7 per cent, and for those submitted to perineal excision, 7.9 per cent.

HAROLD LAUFMAN, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Clarke, R.: A Case of Liver "Sequestrum" Complicating Subcutaneous Rupture of the Liver. *Brit. J. Surg.*, 1941, 28: 544.

The case reported is interesting for two reasons: first, the profound degree of shock associated with the injury due to blood loss, and the treatment which was afforded it; and, second, the rare complication of the laceration of the liver.

The liver injury was an exceedingly large one as it involved the left lobe and extended into the portal fissure, and it varied in depth from 1½ to 4 in. The major portion of the tear was closed with liver sutures and the portion which could not be reached thusly was packed lightly with gauze. The immediate blood volume as determined by Hill's concentrated corpuscle method was 1.29 liters. The amount of blood lost at operation as determined by soaking out the sponges and determining the hemoglobin content was not less than 2.4 liters. Pre-operatively, the patient was given 540 c.cm. of recalcified citrate serum, and a total of 2,020 c.cm. of blood in the postoperative period. With this amount of blood, no disturbance of renal function was noted. The packing was removed gradually and was all out by about the seventeenth day. The patient subsequently developed a purulent discharge and, later, pain in the upper abdomen. A lipiodol study was then undertaken which showed a large cavity with, however, a filling defect. The cavity was noted to communicate with the duodenum via the bile passages.

On the thirty-seventh day following the original injury, the patient was re-examined and the large abscess cavity was found to be filled by a completely separated liver sequestrum, 9 by 6 by 1 cm. in size. Section of the specimen showed it to be "liver tissue, completely necrotic, but not autolyzed." The presence of this sequestrum is extremely unusual and there are no other cases reported in the recent literature.

JOHN W. EPTON, M.D.

García Palazuelos, P., and Lerner, J.: The Diagnosis and Treatment of Amebic Abscess of the Liver (Diagnostico y tratamiento del absceso hepatico amebiano). *Rev. méd. de Chile*, 1941, 69: 67.

The authors discuss their experience with amebic abscess of the liver for the past six and one-half years. They have had 92 cases of abscess of the liver, 80 per cent of which were amebic. As a result of their treatment they recommend early and intensive treatment with emetine hydrochloride. On an average they give 0.72 gm. subcutaneously during the first nine days, with daily doses of 0.12 gm. for the first three days, 0.08 gm. for the second three days, and 0.04 gm. for the third three days. Then after an interval of about ten days they give 0.4 gm. in the course of six or seven days. The details, of course, vary somewhat in different cases. They have had cures in 70 per cent of their cases with this treatment.

As abscess of the liver is an incident in the course of a chronic infectious disease the treatment should be kept up for a period of from twelve to eighteen months after the abscess is cured. Puncture and evacuation of the pus is a good auxiliary treatment in some cases, as for instance those of large sterile abscesses, and should always be tried before operation is attempted.

If emetine treatment fails it suggests either a mistaken diagnosis, multiple abscesses, or secondary infection, probably with streptococci. In such cases a combined treatment with sulfamid, continuation of the emetine treatment, and evacuation by puncture has proved successful. There has been no mortality in the authors' cases which have been treated medically. Among the cases treated surgically, both complicated and uncomplicated cases included, the mortality has been 4.3 per cent.

The authors conclude that surgery should be used only in cases in which medical treatment has failed. Its chief indications are secondary infection, abscesses that require evacuation but cannot be reached by puncture, large abscesses that do not show improvement on puncture, and abscesses that have perforated into the abdomen.

AUDREY G. MORGAN, M.D.

Opazo, F.: The Diagnosis and Treatment of Amebic Abscess of the Liver (Diagnostico y tratamiento del absceso hepatico amebiano). *Rev. méd. de Chile*, 1941, 69: 74.

The author says that in recent years there has been a great deal written on the success of medical treatment in abscess of the liver and little on surgery of this condition. Nevertheless there is still a field for surgical intervention in this disease.

There are two stages of the disease, the first or inflammatory stage, and the second or suppurative stage in which pyogenic bacteria are frequently associated with the amebas. In the first stage of hepatitis medical treatment is indicated. In the second stage, after the development of abscess, medical treatment may also be used if the abscess is small, but in all larger abscesses surgical treatment is indicated. During the transition between the two stages the sulfanilamides may be used in association with emetine to combat pyogenic infection.

As most patients with amebic abscess have a certain degree of insufficiency of the liver, local anesthesia should be used in order not to aggravate the insufficiency. The diagnosis is based on the clinical signs and laboratory and roentgen examination but it can be determined absolutely only by exploratory puncture. The operation of choice is hepatotomy with drainage. If the abscess is in the upper posterior part of the liver the transpleural route is used, with resection of the ribs; in other localizations the abdominal route is used. Operative results have been improved by continuing the medical treatment during the postoperative course.

In the discussion ALESSANDRI said that he believed that medical treatment should be tried first in all cases of amebic abscess of the liver, and surgery should be resorted to only in case of failure of this treatment. It is impossible to differentiate clinically between small and large abscesses of the liver. There is no insufficiency of the liver in at least 50 per cent of the cases of abscess.

VILLAROEL said that he did not believe that there was any danger that the intravenous use of emetine would cause neuritis if vitamins and strychnine were administered.

URRUTIA said that he believed daily doses of 8 cgm. of emetine were large enough. In old cases the prognosis is always bad whether they are treated medically or surgically.

LERNER said there is danger of irritating the intestine if purgatives are given. He believes that there is danger in the intravenous use of emetine.

ARMAS said that he believed that if enlargement of the liver persisted after apparent cure of an abscess, puncture should be made and if pus was found operation should be performed. Often there is no fever in abscess of the liver; in at least 50 per cent of the cases there is no leucocytosis and if there is any it is moderate.

GARCÍA recommended the use of large doses of emetine; there is often recurrence after the use of small doses.

OPAZO said that the high mortality of surgery was partly due to the fact that the patients were kept under medical treatment too long and came to the surgeon in very bad condition.

AUDREY G. MORGAN, M.D.

Ocaranza, F.: Total Hepatectomy, Partial Hepatectomy, and Regeneration of the Liver (Hepatotectomía total, hepatectomía parcial y regeneración del higado). *Gac. méd. de México*, 1941, 71: 477.

Total extirpation of the liver in laboratory animals has been practiced since the time of Galen. Formerly it always resulted in death of the animals in a short time. Batrachians, whose portal system communicates freely with the kidney vessels and the vena cava, survived for two or three weeks. In birds total hepatectomy was possible because the portal system communicates freely with the vena cava and after a technique was devised for establishing such a communication operatively in mammals, longer survival was possible in them after total hepatectomy.

Although survival for any great length of time is impossible after total hepatectomy the liver is so large that survival is possible after removal of as much as half or even two-thirds of its tissue. The history of such partial hepatectomies and their histological and chemical results are described.

The author has experimented with partial resection of the liver in guinea pigs. He describes the histological findings after such resections and illustrates them with photomicrographs. In contrast with the descriptions of regeneration of the liver cells seen in dogs and rabbits, there was no hyperplasia of the remaining liver cells in these animals but only a metaplasia of both the liver cells and the

cells of the reticulo-endothelial system. The liver tissue left in place did not increase in size but remained reduced and about 75 per cent of the animals died in from four days to three weeks after the operation. AUDREY G. MORGAN, M.D.

Liedberg, N.: Experiences with Primary Cholangiography, with Special Reference to the Possibility of Damaging the Pancreas (Erfahrungen mit primaerer Cholangiographie, unter besonderer Beruecksichtigung etwaiger Schaedigungen des Pankreas). *Acta chirurg. Scand.*, 1941, 85: 261.

Primary cholangiography is roentgenological visualization of the biliary passages after they are filled with a contrast substance at the time of operation, while secondary cholangiography is the same procedure carried out any time after the operation. Preoperative cholangiography by means of a special double-lumen double-balloon duodenal tube has been described but has not found wide acceptance.

While secondary cholangiography serves mainly to clarify disturbances of the postoperative course and to reveal the proper time for removal of a hepatic drain, primary cholangiography has "prophylactic" diagnostic value, as it may determine further operative procedure decisively. Some surgeons recommend it heartily and use it routinely in all operations on the biliary passages, while others decline it.

It is said that it prolongs the operation unduly. Liedberg says that it consumes but a few minutes, and as these operations are usually not done under general anesthesia, it does not amount to much. Liedberg uses diodrast diluted with equal amounts of normal saline (17.5 per cent) solution. It mixes well with bile, and there is no detrimental influence on the biliary-passage epithelium. While it is true that the classic position of the patient cannot be used, as a tunnel for the cassette has to placed under him, this really does not amount to a disadvantage. Technically the following details are important:

A good x-ray machine is necessary to permit satisfactory pictures with an exposure of one second or less. Pictures are taken with arrested respiration. This is easily obtained in a conscious patient, and is induced in an unconscious patient by giving enough oxygen to produce temporary apnea. After exposure of the cystic duct, a blunt curved cannula is inserted into it through a lateral incision and fastened either with a clamp or a ligature. After the injection of 10 c.cm. of the 17.5 per cent diodrast solution the picture is taken, and usually, another injection of 10 c.cm. is given which is followed by another exposure. While the films are being developed, the gall bladder can be removed, but the cannula and clamp or ligature remain, in case a check-up cholangiography should become necessary.

Normally, the contrast substance reaches far up into the biliary tree. The width of the common duct shadow varies in normal cases from 2 to 13 mm., while in patients with lithiasis it varies from 4 to 25 mm. Common-duct stones appear as round or facetted defects in the contrast shadow. Stones in the papilla give the typical picture of a "nail set." Even in cases in which clinically the diagnosis of choledocholithiasis is obvious, cholangiography is not superfluous. It informs as to the number and position of the stones and, may even help to save time for after removal of all the stones seen cholangiographically further search for stones will be unnecessary. As shown by some of the author's cases, primary cholangiography serves sometimes to reveal stones which otherwise would have remained unnoticed and whose presence could have jeopardized the success of the operation. On the other hand, some of Liedberg's cases show that a negative cholangiogram is not proof for the absence of common-duct stones.

While contrast substance normally flows into the duodenum and shows up there on the cholangiogram, lack of duodenal filling does not prove anatomical obstruction of Vater's papilla, as spasms can lead to the same result. Such spasms seem to occur after exploratory sounding of the common duct.

Diseases of the pancreas lead to abnormal cholangiograms: carcinoma is said to produce complete and abrupt cessation of the choledochus shadow, and chronic inflammation supposedly produces a fusiform irregular shadow. Liedberg shows a picture from a case with a malignant tumor compressing the hepatic duct close to the portal vein. In cases of suspected malignancy he recommends cholangiography from the gall bladder rather than from the cystic duct, in order to preserve the gall bladder for anastomosis, should one decide upon this. Occasionally one sees filling of the pancreatic duct. This results from a common terminal duct of the pancreas and biliary system which is sometimes found. Liedberg agrees with those who believe that filling of the pancreatic duct is of no pathological significance.

In order to determine whether reflux into the pancreatic duct leads to damage of the pancreas, Liedberg studied the diastasis excretion in all his cholangiography cases for a few days, by means of Wohlgemuth's method. In 8 of 50 cases pathological diastasuria was found, usually beginning about twenty-four hours after operation. As he points out, the interpretation of this finding is rather doubtful, but it cannot be denied that it may express a certain damaging influence of the cholangiography upon the pancreas. He suggests that the contrast substance be injected slowly, and that cholangiography had better not be done in patients with acute inflammatory diseases of the biliary passages.

HEINRICH LAMM, M.D.

Boyden, E. A.: Hypertrophy of the Sphincter Choledochus. *Surgery*, 1941, 10: 567.

An autopsy of a woman seventy-four years old is described. Three enormous gall stones were impacted in the lower end of the common bile duct. These had distended the duct to almost the size of the duodenum, and the lowest one had telescoped the major papilla so that it protruded into the lumen of the gut for a length of 3.5 cm. The roof of the papilla had developed a small fistula which eventually would

have permitted expulsion of the stones into the lumen of the gut and the production of a gall-stone ileus.

The author dissected and made serial sections of the choledochoduodenal junction in an attempt to determine the reaction of the musculature of the papilla to the pressure of the terminal stone. These studies revealed a dense hypertrophy of the sphincter choledochus.

It was presumed that a moderate-sized stone which was too large to be passed at once reached the lower end of the papilla and was held by a spasm of the sphincter choledochus. As the stone grew by accretion, the sphincter correspondingly hypertrophied. The stone being held by other stones in its rear telescoped the papilla, drew the mucosa of the duodenum out upon it, and finally eroded the roof of the papilla; but before it could escape, death from liver damage intervened. S. Lloyd Teitelman, M.D.

Colmer, M. L., and Mersheimer, W. L.: The Relation of Splenic Extract to the Etiology of Essential Thrombopenia. *Arch. Surg.*, 1941, 43: 422.

An attempt was made by the authors to confirm the work of Troland and Lee, who in 1938 reported 3 cases of thrombopenic purpura in which they were able to prepare from the patient's spleen an extract which had platelet-reducing properties when injected into rabbits. In all 3 of their cases, splenectomy was successful in producing amelioration of the symptoms.

In all, 4 spleens were used in the experiments reported. The history and clinical and laboratory findings of 1 of the patients whose spleen was used are given in detail; in the case of the second spleen which was used, a diagnosis of essential thrombopenic purpura was made at another institution, from which the spleen was obtained; nothing was known about the histories of the patients from whom the remaining 2 spleens were obtained; the last 2 spleens were used as controls.

The results of the 17 experiments performed with acetone extracts of spleens were as follows:

In only 2 cases (rabbits Nos. 1 and 3) was thrombopenia produced; the other results were negative, although in some cases there were slight transitory drops. No spontaneous hemorrhagic phenomena appeared in the 2 cases in which thrombopenia occurred. In several cases the counts rose rather than dropped. The control extracts also produced negative results. Eugene J. Audi, M.D.

GYNECOLOGY

UTERUS

Novak, E., and Richardson, E. H., Jr.: Proliferative Changes in the Senile Endometrium. *Am. J. Obst. & Gynec.*, 1941, 42: 564.

A study was made of the endometrium of 137 women after a period of from two to forty years following the menopause. Less than one-half of the cases (62) showed the atrophic changes usually looked upon as characteristic of the senile endometrium. Fully 42 presented pictures of proliferative activity, moderate in 14, while 28 showed considerable areas of outspoken hyperplasia similar to that seen so often during reproductive life. These findings are no doubt to be linked up with the well known fact that estrogen may be produced long after the menopause. The source of this postmenopausal estrogen is not definitely known, although it seems reasonably certain that it is not the ovaries, but rather some of the other endocrine glands, probably the adrenals.

The cases in this series were studied in age groups, and showed a striking lack of correlation between the age of the patients and the histology of the endometrium. The mucosa of some women showed marked atrophy within a few months of the last period, while that of others, thirty or forty years later, showed striking hyperplasia. The latter, for example, was found in 5 women of seventy years or more, the oldest being eighty-seven years.

The clinical importance of these findings lies in the fact that postmenopausal bleeding is a not infrequent symptom in such cases, and it would seem likely that this is due to a hormonal mechanism like that involved in the common functional hemorrhage of the reproductive era.

The remaining 33 cases in this series revealed a histological picture which the authors considered as representing a retrogressed hyperplasia. It was characterized by a typical swiss-cheese pattern, but with obvious evidence of retrogression and inactivity, such as fibrosis of the stroma. The significance of this endometrial pattern is that the hyperplasia pattern found in a large proportion of menopausal women persists for many years thereafter although the causative hormonal factor is no longer operative. Finally, the findings suggested that this residual hyperplasia, rather than inflammation or stromal cicatrization, is the most frequent explanation of the cystic-gland distention that is so often present in senile endometrium.

EDWARD L. CORNELL, M.D.

Lebowich, R. J., and Ehrlich, H. E.: Mesodermal Mixed Tumors of the Corpus Uteri. *Surgery*, 1941, 10: 411.

Mesodermal mixed tumors of the body of the uterus belong to a remarkable group of bizarre tumors which originate from cells normally absent in the uterus. The authors were able to collect from the literature only 12 true mesodermal tumors of the corpus acceptable to the pathological criteria of Lawen. In addition the authors present a case of their own. In the light of present evidence, an origin from embryonal cell rests of the muellerian duct appears to be the most acceptable today but is not completely satisfactory. The strength of this theory lies not only in the location of the tumor, but also in the pluripotential capacity for differentiation of the indifferent embryonal cells into myxomatous tissue and bone.

This group of tumors has been distinguished from other complex tumors of the uterus, such as teratomas, rhabdomyoblastomas, and complex sarcomas, by the adoption of certain pathological criteria. The necessity of the presence of embryonal myoblasts in association with one or more heterologous elements for pathological diagnosis was emphasized. The predominance of embryonal myoblasts in the primary growth is of grave prognostic significance because of their propensity to invade the blood stream.

Because of early extension into the blood stream, complete removal of the uterus and its appendages is indicated. Postoperative deep x-ray therapy is worthy of a trial because of the essentially embryonal character of the tumor. No five-year cures have been reported in the literature.

CHARLES BARON, M.D.

Danforth, W. C.: Total Hysterectomy, Abdominal and Vaginal. *Am. J. Obst. & Gynec.*, 1941, 42: 587.

To avoid the danger of cancer in the retained stump and to free the patient from the annoyance which may be caused by the unhealthy stump, a wider use of the total removal of the uterus is recommended. Total hysterectomy may be done either abdominally or vaginally, as the conditions of the individual case may suggest.

The gynecological specialist should be able to remove the uterus either abdominally or vaginally with sufficient ease that his choice of operation is not influenced by his lack of experience with one or the other, and he should not choose the incomplete operation instead of the complete because he feels that he can do it more easily. The technique of either of these operations may be developed by the experienced operator.

The objections which have been made against the complete removal of the uterus disappear if a proper technique is used. Total removal in experienced hands, either abdominally or vaginally, does not subject the patient to increased risk.

The operator of small experience in pelvic surgery should make use of the subtotal operation.

EDWARD L. CORNELL, M.D.

MISCELLANEOUS

Way, S.: Cullen's Sign. *J. Obst. & Gynaec. Brit. Emp.*, 1941, 48: 473.

The best description of Cullen's sign that has yet appeared in the literature is that of Schumann, namely, peri-umbilical ecchymoses. The sign is due to the presence of blood pigments in the abdominal wall, usually in the region of the umbilicus or near operation scars, which look exactly like bruises. This sign appears to be of great rarity; it has been described in the literature on only 45 occasions, referred to on 2 other occasions, a similar sign was mentioned twice, and in this article the author records 3 more cases—52 in all.

The sign was first described by T. S. Cullen in 1918, and his article was published in that year in the *American Journal of Obstetrics*.

Pseudo-Cullen's sign, or Hofstatter's sign, consists of a blueing of the umbilicus due to the color of blood shining through an umbilical hernia. It has also been described in connection with incisional and femoral hernias.

Cullen's sign is not pathognomonic of extra-uterine gestation, but may occur with any intraperitoneal hemorrhage. It has also occurred without intraperitoneal hemorrhage. The following conditions have been associated with this sign:

Ectopic gestation	19
Acute pancreatitis	8
Ruptured uterus	3
Hematoma of the rectus sheath	1
Ovarian cyst	1
Pyosalpinx	1
Hepatic hemorrhage	1

In 2 of the author's cases the cause of the sign was rupture of an old cesarean-section scar. The third instance was found to be due to a hematoma in the rectus sheath.

Three explanations of this sign have been advanced: (1) the simple soaking through of blood pigments from the peritoneum to the skin; (2) blood pigments reaching the abdominal wall via the lymphatics; and (3) spread of the blood pigments by means of an abnormal aperture in the peritoneum other than a hernia. The author is in favor of the last of these three theories.

DANIEL G. MORTON, M.D.

Sealey, J. L., and Sondern, C. W.: Comparative Estrogenic Potency of Diethyl Stilbestrol, Estrone, Estradiol, and Estriol. Uterine and Vaginal Changes in Infantile Rats. *Endocrinology*, 1941, 29: 356.

The authors present a comparative study of the estrogenic activity of stilbestrol, estrone, α-estradiol, and estriol made by means of the oral and subcutaneous administration of these substances to infantile female rats. Their findings were the same as those of previous investigators. Assayed subcutaneously, estrone, α-estradiol and estriol were found to be respectively, one-sixteenth, one-fourth, and one-fortieth as effective as stilbestrol; orally the relationship was one-sixteenth, one-eighth, and one-third. Stilbestrol orally had about the same activity as an equal subcutaneous dose of α-estradiol. The degree of stimulation from stilbestrol observed grossly or histologically was found to have exceeded that attained by any of the natural estrogens.

CHARLES BARON, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Burnham, L.: The Common Etiology of Erythroblastosis and Transfusion Accidents in Pregnancy. *Am. J. Obst. & Gynec.*, 1941, 42: 389.

The incidence of erythroblastosis has been given as 1 in every 2,000 confinements. This includes the three accepted clinical forms, namely, hydrops fetalis, icterus gravis, and congenital anemia of the newborn. In recent years it has been realized that the disease is more frequent than was formerly thought. The author reports an incidence of 1 in 200.

Erythroblastosis fetalis is due to the destruction of the baby's blood by the anti-rhodium agglutinin, which has been formed in the mother's blood by immunization of a rhodium-negative mother by a rhodium-positive baby.

Severe transfusion accidents in the mothers of erythroblastic babies are exceedingly common and likewise are due to the destruction of the donor's blood by the anti-rhodium agglutinin. These reactions are almost always, if not always, preventable by means of a modified cross-matching technique.

The mothers of erythroblastic babies may be safely transfused, preferably after determination of their rhodium status, and usually by the use of rhodium-negative blood. Erythroblastosis is more common than is generally appreciated. The group includes cases other than those belonging to the three accepted clinical forms of hydrops fetalis, icterus gravis, and congenital anemia of the newborn. Early blood counts of suspicious babies (with early jaundice and/or anemia) will permit the saving of many babies by transfusion.

EDWARD L. CORNELL, M.D.

Mikulicz-Radecki, F. von: Radium Treatment of Cervical Carcinoma During Pregnancy with the Aim of Obtaining a Full-Term and Healthy Child (Radiumbehandlung des Collumcarcinoms waehrend der Schwangerschaft mit dem Ziel eines ausgetragenen, gesunden Kindes). *Strahlentherapie*, 1941, 69: 45.

A report is given of 3 cases in which, because of cervical carcinoma during pregnancy, treatment was undertaken without any attention to the offspring. In the first case following total extirpation without postoperative irradiation, there was complete freedom from recurrence after five years. In the second case which was operated exactly as the first, recurrence, which occurred one year after operation, finally proved fatal three years following the operative procedure. In the third case, intracervical irradiation was administered, and this was followed by spontaneous delivery of a stillborn fetus 39 cm. long. In spite of further radium irradiation the patient died shortly afterward.

In contradistinction to these 3 cases, a combination of cervical and vaginal radium irradiation was carried out in a fourth case and at the calculated termination of pregnancy, a living fetus was delivered by cesarean section. This was followed by a Freund-Wertheim radical operation and then intensive x-ray irradiation was carried out. After two and one-half years the patient was completely free from recurrence. In the fifth case, the patient, who had previously been irradiated with radium, did not enter the clinic for cesarean section, but delivered spontaneously at home. The child in this instance, just as in Case 4, was alive and at full term. In this case a second radium irradiation was administered and this patient also was found to be completely free from recurrence two and one-fourth years later. No injury due to irradiation could be found.

Without drawing any definite conclusions from these 2 cases (Nos. 4 and 5) the author is of the opinion that one should venture conservative radium irradiation in combating cervical carcinoma which is discovered toward the end of pregnancy (in combination with a simultaneous x-ray irradiation) in the hope of obtaining a viable offspring. However, the future course of these offspring who were born alive must be carefully observed in order to determine whether some type of cerebral injury caused by the radium irradiation may not develop.

In suitable cases, it is worthwhile to bear in mind this remarkable therapeutic recommendation.

(W. RUEBSAMEN). HARRY A. SALZMANN, M.D.

PUERPERIUM AND ITS COMPLICATIONS

Leinzinger, E., and Bayer, R.: The Treatment of Early Mastitis in the Puerperium. The Local Use of Synthetic Estrogenic Substances (Zur Behandlung der Fruehmastitis im Wochenbett. Lokale Anwendung synthetischer oestrogener Wirkstoffe). *Geburtsh. u. Frauenheilk.*, 1940, 2: 414.

Reasoning from the fact that follicle hormone has a very powerful effect upon the breast when applied locally, the authors treated early cases of mastitis with stilbestrol applications. The results must be considered as extraordinarily good. In 64 cases suppuration occurred only twice. Inhibition of lactation was not observed regularly; it affected only the involved side and was temporary: practically all of the patients were again able to nurse their babies.

The results were compared with those obtained in cases at the same clinic which were treated with the x-rays. With the stilbestrol treatment absolute cure was obtained in 90.6 per cent of the cases with lactation, whereas with the x-ray treatment good results were obtained in only 71.4 per cent.

The treatment consists in the application twice daily of 4 or 5 cc. of normal-strength stilbestrol salve (0.1 mgm. of stilbestrol to 5 cc.), the breast

being nursed or emptied by the suction pump. Even in late cases showing no tendency to resolve the author has obtained good results.

(UFER). LEO A. JUHNKE, M.D.

MISCELLANEOUS

Moir, J. C.: Detecting Pelvic Contractions. *Edinburgh M. J.*, 1941, 48: 361.

In seeking more accurate, yet not complicated or too expensive, means of obtaining internal pelvic measurements, the author has adopted the x-ray method of Thoms, using the tube at a five-foot distance to lessen distortion. Of any single view, the lateral one is most important, and also the easiest to obtain. A notched measuring rod is positioned in the cleft of the buttocks as the patient stands erect (Fig. 1). From a picture so made in the last weeks

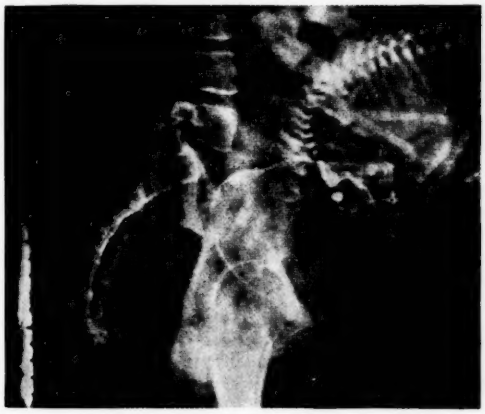

Fig. 1. Example of lateral pelvimetry and cephalometry. Note the measuring rod marked in centimeters.

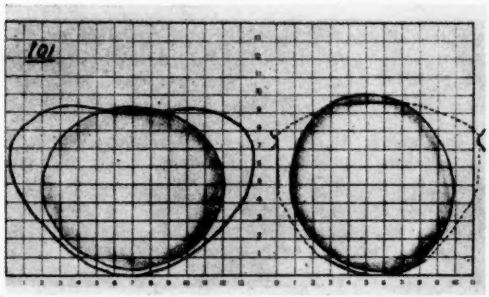

Fig. 2. Example of simple flat pelvis, i.e., anteroposterior contraction of brim and of lower pelvis.

of pregnancy, the following information can be obtained:

1. The presentation of the fetal head
2. The measurement of the shortest diameter of the fetal head
3. The relationship of the head to the pelvis
4. The length and shape of the sacrum
5. The depth and inclination of the symphysis pubis
6. The measurement of the anteroposterior dimensions of the pelvis at (a) the brim (the conjugata vera), (b) the midpelvis, and (c) the outlet
7. The measurement of the distance between the sacrum and a line joining the ischial spines (the width of the sacrosciatic notch)
8. The posterior sagittal measurement of the outlet

By plotting the areas available in a given pelvic canal and superimposing on these charts the minimum area required by the flexed fetal head, one may study cases with prognoses of dystocia (Fig. 2).

E. S. BURGE, M.D.

GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Williams, E. R.: Pyelorenal Backflow. *Brit. J. Radiol.*, 1941, 14: 275.

The historical and experimental aspects of pyelorenal backflow are reviewed in some detail. Four types of backflow may be recognized, namely pyelovenous, pyelolymphatic, pyelo-interstitial (occurring after calycine rupture), and pyelotubular, which occurs independently of rupture.

A brief description of the anatomy of venous and lymphatic drainage systems of the kidney is given.

The methods of study in backflow are discussed, especial reference being made to the radiographic methods.

The mechanism of backflow is discussed in relation to: (1) its experimental study, (2) its occurrence in normal and pathological states in the human kidney, and (3) its occurrence during pyelography as a routine investigation.

The roentgenographic appearances of the various forms of backflow are described and illustrated.

The clinical significance of backflow is discussed, especial reference being made to chyluria and its etiology. JOHN A. LOEF, M.D.

Thomas, G. J., Stebbins, T. L., and Sandell, S. T.: The Control and Arrest of Lesions of Renal Tuberculosis. *J. Urol.*, 1941, 46: 579.

The authors have long been of the opinion that early lesions of renal tuberculosis become quiescent, and a few apparently heal, under intensive sanatorium treatment. Clinical data in the histories of 4 cases of renal tuberculosis are presented, and it is concluded that kidneys should and do react toward the destructive effect of tuberculous bacilli in the same manner as other organs and tissues.

The authors do not recommend hygienic treatment as a routine procedure when dealing with all lesions of renal tuberculosis, but advocate that it should be tried when patients have not manifested their ability to control other tuberculous lesions, in those who have other active lesions that may become life-taking, in patients who have a small renal lesion that does not progress, in patients whose clinical data suggest bilateral renal involvement, and when any doubt exists concerning the correctness of the diagnosis. D. E. MURRAY, M.D.

Bugbee, H. G.: Tuberculoma of the Kidney. *J. Urol.*, 1941, 46: 355.

A case of true tuberculoma of the kidney, in which the urographic and gross pathological findings were characteristic of tumor of the renal pelvis, is presented as a review of the literature by the author revealed no reference to a tuberculoma of the kidney.

The symptomatology of the presented case was of five weeks' duration and was initiated by frequency of urination and dysuria. This was followed three weeks later by gross hematuria, hypogastric discomfort, and a dull ache in the left lumbar region. General physical and laboratory examinations were essentially negative, but excretory urograms showed a very definite filling defect suggestive of a tumor of the kidney pelvis. The bladder urine upon direct smear contained clumps of pus cells and acid-fast bacilli which corresponded morphologically to tubercle bacilli. After removal, the kidney was split throughout its length and the pelvis was found to be filled with a smooth, pinkish firm mass which had the appearance of renal tumor. However, a frozen section showed on microscopic examination that the diagnosis of tuberculosis was correct.

D. E. MURRAY, M.D.

Norris, R. F., and Herman, L.: The Pathogenesis of Polycystic Kidneys; Reconstruction of Cystic Elements in 4 Cases. *J. Urol.*, 1941, 46: 147.

Although unilocular and multilocular solitary cysts of the kidneys may be formed after birth, and the cysts and dilated uriniferous tubules associated with advanced nephritis may be secondary to the postnatal inflammatory lesions of the kidneys, the fetal origin of diffusely occurring cysts of the kidneys found in infancy or in later life has generally been accepted.

In general the most likely causes of polycystic kidneys may be grouped as follows: (1) inflammation, either syphilitic or nonspecific; (2) structural anomalies of development resulting from an abnormal proliferation of tissue; (3) failure of individual elements from the separate anlagen to unite; and (4) persistence of normally provisional nephrons.

The important theories of origin of polycystic kidneys have been reviewed. Four cases of congenital polycystic disease of the kidneys have been described. From serial sections, several collecting ducts and cysts in the kidneys of each case have been reconstructed to scale in drawings.

Evidence has been given that for a long peiod in fetal life development of the kidneys was normal. Focal cystic dilatations of uriniferous tubules and collecting ducts occurring after differentiation of the metanephrogenic anlage and after the union of its elements with collecting ducts was followed by the isolation, as cysts, of segments of these nephrons. Anastomoses among these cysts resulted from continued proliferation of these elements and from rupture of their walls.

These changes are thought to be degenerative since they resemble the stages in the normal degeneration of the mesonephros and of normally vestigial elements of the metanephros.

In the case of polycystic kidneys, therefore, to a variable degree the metanephros is abnormally provisional.

Such an explanation appears to be applicable to most of the congenital anomalies associated with polycystic kidneys and to be compatible with the hereditary nature of the disease.

The fundamental cause of polycystic diseases of the kidneys must be in the germ plasm.

D. E. MURRAY, M.D.

Yunck, W. P., Jr., and Forsythe, W. E., Jr.: Calycine Resection. Report of Clinical and Experimental Cases. *J. Urol.*, 1941, 46: 396.

The most common site of calycine stones is the inferior calyx. As the urinary excretion for each calyx is estimated to be about 3 drops of urine per minute, it is obvious that the urinary stream is far too sluggish to wash crystals and other particles out of a dependent calyx. Other calyces, we find, sometimes have a markedly narrowed or strictured infundibular portion, which acts to make the calyx retentive. In recent years there has been a definite decrease in stone recurrence. This is probably due to both improved operative surgery and closer roentgenographic check-up at the operating table, as well as careful postoperative treatment. Stone recurrence, however, is still one of the major problems confronting the urological surgeon. The authors' technique of calycine resection is as follows:

The patient, properly anesthetized, is placed in the kidney position and draped. The kidney is exposed through the usual lumbar incision and carefully delivered, the ureter, pelvis, and renal pedicle being gently freed from the surrounding areolar tissue. A wedge-shaped section of cortical and medullary tissue, containing the involved calyx and the stone, is removed in a radial manner. It is believed that by cutting radially, the interlobular arteries in the remaining parenchyma are less involved. The surgical defect is approximated over a small piece of fat by ribbon-gut sutures placed through the true capsule in the manner described by Lowsley.

A large nephrostomy tube is placed in the renal pelvis, and a No. 8 F. or 9 F. splinting ureteral catheter is placed through a separate nephrostomy opening. This can be done bluntly, and approximation by suture is usually unnecessary. The wound is closed in layers with drainage. The nephrostomy tube is irrigated only when this is necessary in order to secure good drainage. The ureteral catheter is removed at the end of a week, and the nephrostomy tube from three to five days later.

The pathogenesis, location, and recurrence of calycine calculi have been briefly discussed, and a method of calycine resection has been reported. In 16 cases there was prompt healing, minimal resistant infection, and no recurrence of stone. In 3 other cases there was severe postoperative bleeding, which may have been a factor in the poor end-results.

The end-results of the operation were studied in 13 dogs. In 10 the calyx was resected with the scalpel, with no fatalities. Healing began promptly and was complete at the end of fourteen days. Normal parenchyma, in which there was no evidence of ascending infection, was observable within 2 mm. of the operative scar. Although microscopic amounts of calcium and, in 1 case, bone formation were noted in the scar, the pelvis was completely re-epithelized in all cases and there were no subepithelial plaques. In 3 animals, the calyx was resected with the high-frequency cutting current. Two died, 4 and 5 days after the operation, respectively. The third animal showed marked local sepsis and no evidence of healing.

In selected cases of calycine calculi, resection of the stone-containing calyx is indicated because

1. Resistant infection is usually not a factor.
2. Healing is prompt, with little danger of a permanent urinary fistula.
3. There is little decrease, postoperatively, in the function of the kidney, as shown by a comparison of the pre-operative and postoperative urea and phenolsulfonphthalein determinations.
4. Most cases show no recurrence of stone either at the operative site or in other calyces.

From animal experiments, it would appear that resection of the calyx with the scalpel is definitely superior to resection with the high-frequency cutting current.

JOHN A. LOEF, M.D.

Atcheson, D. W.: Perinephric Abscess, with a Review of 117 Cases. *J. Urol.*, 1941, 46: 201.

A review of 117 cases of perinephric abscess observed at Charity Hospital in New Orleans, Louisiana, is presented with a summary of the symptomatology. The author concludes that perinephric abscess may present a variety of clinical pictures and should always be considered in cases of prolonged fever.

In most cases a pyogenic lesion occurs in the renal parenchyma before the perirenal space is involved. The secondary involvement of the perinephric space may occur by direct rupture of the abscess or may follow the veins and lymphatics between the kidney and the space.

There are 2 main groups of lesions which precede the kidney lesion: (1) distant foci of infection such as furuncles, and (2) chronic diseases of the kidney itself, such as calculi or pyonephroses. These abscesses occur most commonly in males between the ages of twenty-five and forty-five years.

The onset is usually prolonged and the diagnosis is seldom made before the patient has had symptoms from five to six weeks. Positive roentgenograms are becoming more important in making the diagnosis, but too much emphasis should not be placed on negative films.

Practically all patients have pain, costovertebral tenderness, fever, and leucocytosis, but in a great many cases some of the commonly stressed findings such as psoas spasm, flexion of the hip, and changes in the urine will not be present. The postoperative course is prolonged and coupled with a high mortality rate.

The only treatment is incision and drainage with postoperative supportive measures. It is best not

to close the wound too tightly, and in certain types of cases, a counter incision in the lower abdominal wall will facilitate recovery. D. E. MURRAY, M.D

Fey, B., Dossot, R., and Wolfromm, G.: The Role of Transurethral Resection in the Treatment of Diverticula of the Bladder (Du rôle de la résection trans-urétrale dans le traitement des diverticules de vessie). *Mém. Acad. de chir.*, Par., 1940, 66: 627.

The anatomical and clinical differences in diverticula of the bladder have raised many discussions concerning their surgical indications, but the relatively recent introduction of transurethral resection has offered new possibilities. For this reason the authors think it advisable to establish the indications of this resection on the basis of 20 recent personal observations.

Some diverticula of the bladder may be congenital, especially in women and when other malformations coexist, but as a rule they are acquired and secondary to a dysectasis of the vesical neck. A diverticulum of the bladder is a hernia of the vesical mucosa through the mural musculature which is hypertrophied by its efforts to overcome the dysectasis of the vesical neck and is dissociated by the distention of the organ. The first degree of the disorder is represented by the bladder with cells and columns typical of chronic distention; later, the lesion is aggravated and appears as numerous, disseminated diverticula, called vesical diverticulosis (5 of the present cases); as two diverticula more or less grossly symmetrical (7 cases); or as one large diverticulum which receives the entire thrust of the effort of voiding (10 cases).

The origin of the diverticula imposes two therapeutic indications: one, which is more or less absolute and depends on the cases, is to eliminate the diverticular pocket; the other, always indispensable, is to intervene on the vesical neck in order to abolish the thrust on the pocket, to obviate its inconveniences, or to prevent its recurrence. To eliminate the diverticulum, the authors use Marion's second method which allows removal of the largest pockets, but they prefer closing the breach inside of the bladder and draining the remaining cavity by the lateral extravesical route. The intervention on the vesical neck will depend principally on the size of its lesion. All statistics agree that diverticula are usually due to small sclerous lesions, not to large congested prostates, and the present cases confirm this view as they include 2 frank adenomas, 3 sclerous adenomas, and 15 disorders of the neck, bars or cervical scleroses. Consequently, transurethral resection is indicated much more frequently than prostatectomy in the complementary treatment of diverticulum of the bladder.

When only prostatectomy and transvesical resection of the neck were indicated, there was general agreement on the following: (1) in case of evident incidents, direct intervention was done on the pocket to extirpate it, cystostomy being insufficient to drain the diverticulum and being therefore incapable of ameliorating the cystitis and the general condition; (2) extirpation of the pocket was technically much more difficult when the bladder had previously been fixed and retracted by a cystostomy; (3) the best sequence of the surgical stages was consequently extirpation of the pocket ended by cystostomy, and followed by secondary removal of the vesical neck or of the prostatic adenoma. As the first intervention took forty-five minutes and the second two minutes, the two stages were usually combined in one operation.

The 20 cases reported by the authors serve to show in what manner this line of conduct has been altered by the introduction of transurethral resection. The diverticulum was the principal lesion in all cases, which included 8 in which extirpation of the pocket or pockets was indicated and performed, 5 in which extirpation was indicated but impossible for local or general reasons, and 7 in which extirpation was not imperative and intervention on the vesical neck only was used.

The authors draw the following conclusions:

When extirpation of the pocket is indicated and possible, transurethral resection may serve as an indispensable complementary stage; according to cases, extirpation of the pocket and resection of the vesical neck may be done in one stage by the intravesical route, or the extirpation may be performed as a first stage and transurethral resection as a second stage. When extirpation of the pocket is contraindicated, resection may provide considerable improvement especially in the presence of multiple pockets that are not too deep; however, the amount of residual urine is equal to the capacity of the diverticula. In any case, the resection does not interfere with secondary extirpation of the pockets if this becomes necessary. If extirpation is not indicated, resection alone improves the drainage of the bladder and allows acting on the cystitis; in addition, it probably prevents the further development of the diverticula. Here also, resection seems indicated as a first stage, and subsequent extirpation of the pockets can always be done later.

RICHARD KEMEL, M.D.

GENITAL ORGANS

Ercole, R., Minnhaar, T. C., and Fort, A.: Thrombosis of the Pampiniform Plexus in a Case of Vaquez Disease (Trombosis del plexo pampiniforme en una enfermedad de Vaquez). *Rev. méd. d. Rosario*, 1941, 31: 644.

Thrombosis of the pampiniform plexus is relatively rare and is often confused with acute orchiepididymal processes or with tumor of the testis, epididymis, or spermatic cord. The authors report a case in a man, aged seventy years, who long ago noticed that the left side of his scrotum and its contents were larger than those of the other side and that they gave him a feeling of painful heaviness on prolonged standing. About twenty days before ad-

mission, his left testis was compressed between the thighs during a fall and rapidly acquired the size of a fist; the swelling decreased under local treatment but did not disappear entirely; he had some pain immediately after the accident, but it decreased gradually during the following days. The skin of the exposed parts of the body had acquired a red vinous tint since more than one year. Examination showed numerous tortuous veins in the skin of the scrotum, which had a purplish red color, and a hard irregular swelling of the upper pole of the testis and of the spermatic cord up to the vicinity of the external inguinal ring. Blood examination revealed Vaquez disease (polycythemia vera). Tumor of the left testis was suspected. At operation the veins of the cord were found enlarged and partly thrombosed up to the external inguinal ring; the testis and cord were removed. Histological examination showed a normal testis, chronic hypertrophic and obliterating endophlebitis, and venous thrombosis.

The basic condition for the production of thrombosis is the presence of an infectious, toxic, or traumatic lesion of the wall of the vein. In the reported case, the histological preparations revealed vascular lesions which antedated by a long time the beginning of the present disease, as some veins showed proliferation of the intima of polypous type, and others thrombosis in the stage of organization. To these lesions must be added those caused by the trauma which undoubtedly must have damaged the already altered wall of the veins, although it was impossible to determine the degree of participation of the trauma in the extension of the thrombosis. The physicochemical condition of the blood is also considered as a factor in the development of thrombosis: in this connection it should be noted that thrombosis occurs with some frequency in Vaquez disease without predilection for special zones of the organism, although the abdominal veins are most often involved and then those of the extremities. Some authors think that the thrombosis in these cases is intimately related to the increase in viscosity of the blood, others to the combination of the increased viscosity with the presence of a much larger number of platelets. In the present case, the viscosity of the blood and the number of platelets were greatly increased. Another factor to be taken into consideration is the slowing down of the circulation by the presence of a varicocele.

In short, the thrombotic process found in this patient cannot be attributed to only one of these factors; all must have contributed: the vascular lesion was the basic element to start the thrombosis and was undoubtedly helped by the retardation of the circulation and even more by the special physicochemical condition of the blood.

The treatment must depend on the extent of the thrombosis and its repercussion on the gland. The fact that the testis was normal in this case suggests the possibility of more conservative treatment, with the reservations indicated by the possible evolution of any thrombosis. RICHARD KEMEL, M.D.

MISCELLANEOUS

Baumeister, C., and Hollinger, N.: Trichomonas Infection of the Male Genito-Urinary Tract. *Arch. Surg.*, 1941, 43: 433.

In this article the clinical and laboratory diagnoses are given in detail. A new method of treatment for trichomonas infection in men is presented, which may prove of value for certain aspects of the infection in women.

On the incidence of trichomonas infection in men, there have been two widely contrasting types of reports. Stuhler found that among 32,000 examinations of prostatic secretion, trichomonas vaginalis was found in only 16, or once in every 2,000 examinations. Riba examined 3,000 specimens of prostatic secretion and obtained only 2 that were positive for the organism. Other authors examined the husbands of women with trichomonas-vaginalis infection and found that a relatively high number of them were likewise infected. Drummond found that 4 of 5 such husbands examined were infected with trichomonas vaginalis.

The authors believe that a damaged or chronically inflamed urethra with lowered resistance seems to favor trichomonas adaptation and local morbidity, and to provide a source for dissemination of the parasites. Of 23 patients whose records were in the office files of Riba and Harrison, 65 per cent admitted previous gonococcic infection; for another 10 per cent there was no information; and 25 per cent gave a history of previous urethral stricture. One sign observed by most authors was a discharge. Heckel stated that the symptoms of trichomonas infection of the prostate are the same as those of non-specific urethritis, i.e., persistent urethral discharge and morning drop, associated with various other genito-urinary complaints. On rectal examination the prostate may be normal in size, shape, and consistency, or there may be areas of hardness or infiltration.

The authors stress the following facts which have been observed by themselves and other workers:

1. It is advantageous to allow the prostatic fluid to drip directly into the Petri dish; this minimizes manipulation and contamination.

2. The relatively sterile technique used to eliminate contaminating organisms makes it possible to report the identification of protozoa, bacteria, and fungi with more assurance than with any previously used easy technique that we have been able to find.

3. The improved type of swab which has been described by the authors helps to minimize the percentage of falsely negative reports.

4. The careful expression of the liquid material from the swabs, a hitherto unpublished method, has advantages, which has been carefully enumerated.

5. The routine centrifuging of wet specimens, which is strongly urged, coupled with the careful, time-consuming laboratory examination, gives the worker a more reasonable sense of satisfaction when he reports a specimen as negative for trichomonas.

In treating a man, it seems logical to use one of the antiseptics which have already proved their parasiticidal action on trichomonas vaginalis in numerous cases of infection in women.

An acetarsone preparation is incorporated into a 2 in. (5 cm.) size (French) urethral suppository. The patient is instructed to insert this after allowing warm water to run on it for a short time so that it will mold more easily to the contour of the urethra. One is inserted after urination in the morning and evening. To obtain prostatic smears, the prostate is massaged lightly about every third day for ten days, and every two weeks for about two months.

JOHN A. LOEF, M.D.

Krichesky, B., Benjamin, J., Belt, E., and Schwartz, M.: Endocrinological Studies on the Prostate Gland in the Male Rabbit. *J. Urol.*, 1941, 46: 303.

The etiology of prostatic hypertrophy remains, even today, one of the obscure problems in urological medicine. It has been widely held that variations in the status of the prostate gland are due to the amount of hormone produced by the testes; that the transformation at puberty is a manifestation of increase in testicular hormone production; and that some prostatic senile changes are due to diminution or cessation of the secretory activity.

There is no observable difference in the response of implants of prostatic tissue from the anterior lobe or from the posterior lobe, made into the anterior chamber of the eye in male rabbits, to castration and to testosterone propionate administration. Administration of 0.1 mgm. or 0.5 mgm. of testosterone propionate per kilogram intramuscularly into male rabbits produces a marked increase in area of the prostatic implant, which reaches a peak approximately two weeks after the injections are begun. This rise in area is followed by a regression which continues even though hormone administration is continued on an even increased dosage.

The administration of testosterone propionate in the same dosages to castrated, completely prostatectomized animals produces a continuous increase in area of prostatic implant for at least a period of three months. There is no peak or regression during this time as is seen in the completely prostatectomized animal with testicles intact.

The daily variation in the size of the transplants observed by Moore and others, and in these studies, is probably not explainable on the basis of fluctuation in the hormone output of the testes, but rather on the basis of systemic changes.

The difference in response of prostatic implants to male hormones in intact animals and in castrate animals suggests that the testis may produce a substance which inhibits the action of the male hormone on the prostatic tissue, or which may indirectly affect the response of prostatic tissue to this particular hormone.

D. E. MURRAY, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Badgley, C. E., and Batts, M., Jr.: Osteogenic Sarcoma; An Analysis of 80 Cases. *Arch. Surg.*, 1941, 43: 541.

The authors state that osteogenic sarcoma is the most common type of primary tumor of bone. In the American Registry of Bone Tumors the incidence is 1,071 in a total of 2,232 cases. The writers record 80 cases in 305,760 registrations at the University Hospital at Ann Arbor, Michigan, from 1925 to 1928.

Fifty per cent of the cases reported by the authors occurred in the *second decade* of life, the youngest patient being eight years of age and the oldest seventy-two. Thirty-six per cent (29 patients) had a history of trauma. The average duration of the symptoms from the time of onset to admission to the hospital was thirteen months.

The outstanding symptoms were pain and swelling, the pain almost invariably preceding the appearance of tumefaction. The pain was usually mild at onset, rapidly becoming more constant and severe, worse at night, and not relieved by rest. Motion of the adjacent joint then became affected and a limp developed if the involvement was in the lower extremity.

Constitutional manifestations were low-grade fever, loss of weight, anorexia, and fatigue. A palpable, hard, tender tumor was present in 73, or 91 per cent, of the cases. Local increased heat and dilatation of the superficial vessels were frequently noted. The location of the lesion was usually at the ends of long bones, in 50 per cent of the cases it being in the vicinity of the knee joint.

The diagnosis was established on the basis of combined clinical, roentgenological, and histological studies in 62 cases. In the remaining 18 cases there was no histological examination but the other findings were typical and metastases and death followed in a short time.

The types and period of survival in 48 cases are shown in a chart.

The treatment of choice was radical amputation without pre-operative irradiation. Palliative roentgen therapy was used in cases not suitable for amputation. The mortality rate was 79 per cent.

The average period of survival in cases with fatal termination was thirty-one months. The average period of survival of those who are living is eighty-four months. There were 15 five-year survivals (19 per cent) and 4 ten-year survivals. One patient died from pulmonary metastases which developed thirteen years after amputation at the middle of the thigh. The average period of survival following treatment for the entire series was twenty-nine months. Forty-one patients were less than twenty years of age; in this group the average period of survival was twenty-one months and there were 6 five-year survivals (15 per cent). Among the 39 patients more than twenty years of age, the average period of survival was thirty-five months and there were 9 five-year survivals (23 per cent). Thus in the older group the prognosis was better both with regard to average period of survival and percentage of five-year survival.

Those patients who received treatment more than six months after the onset of symptoms had a better prognosis than those who came seeking treatment less than six months after the onset. It is believed that the apparent indication for delay of treatment lies in the fact that a more malignant type of lesion drives the patient to seek aid earlier in the course of the disease.

In the patients who had biopsies the average period of survival was twenty-eight months compared with an average of thirty-five months for those who did not have biopsies This evidence is regarded as merely suggestive of the danger of preliminary biopsy. In correlating the site of the lesion and period of survival, it was noted that the more central lesions had a shorter average period of survival and fewer five-year survivals.

The most important factor in determining the prognosis in any patient was shown to be the type of lesion. Progressing from the least to the most favorable prognosis, the order was found to be osteolytic osteogenic sarcoma, chondroblastic sarcoma, primary myxochondrosarcoma, secondary chondrosarcoma, and sclerosing osteogenic sarcoma.

Forty-three patients were treated by amputation and 37 by irradiation with or without local excision. For the 43 treated by amputation the average period of survival was forty-two months, and there were 13 five-year survivals. For the 37 treated otherwise the average period of survival was fifteen months, and the number of five-year survivals was only 2. This indicates that amputation still offers the best chance of cure in osteogenic sarcoma. The results in patients treated by amputation plus roentgen therapy were a little more favorable than those treated by amputation alone.

The dictum that amputation should be carried out through the next higher joint at least and never through the involved bone is without support. Death is almost always due to distant pulmonary metastases and the more centrally located the lesion, the poorer the prognosis. It is believed that for any lesion in an extremity, the lowest level of amputation compatible with complete eradication and the requirements for a suitable prosthesis should be considered satisfactory.

In summarizing their results the authors conclude that osteogenic sarcoma is the most common type of primary malignant tumor of bone. It is primarily a disease of the young, one-half of the patients being in the second decade of life. It is more common in

men than in women. Only a small proportion of the patients have a family history of one or another type of malignant lesion. Trauma is noted in about one-third of the patients.

The average duration of symptoms from the onset until diagnosis is thirteen months. The outstanding symptom is pain followed by swelling. A palpable tumor is present in 90 per cent of the cases. The lesions show a marked predilection for the ends of long bones; about 50 per cent of the lesions appear in the vicinity of the knee joint. The diagnosis is based on a combination of characteristic clinical findings and roentgenographic and histological observations. The treatment of choice is primary amputation. If the lesion is not amenable to amputation, local excision should be carried out in conjunction with roentgen therapy.

In this series there was a mortality rate of 79 per cent. The average period of survival was forty-one months. Among 80 patients there were 15 five-year survivals, an incidence of 19 per cent. There were 4 ten-year survivals, an incidence of 5 per cent. One patient died of pulmonary metastases which developed thirteen years after an amputation at the middle of the thigh. The prognosis is more favorable for patients over twenty years of age. It is less favorable for patients with a relatively short duration of symptoms when the diagnosis is established, for the more lethal lesions drive the patients to seek earlier treatment. The danger of dissemination of tumor cells by biopsy has not been conclusively shown. In the extremities, the more central the lesion the poorer is the prognosis. The prognosis varies directly as the degree of differentiation of the lesion. If the lesion occurs in an extremity the period of survival is most favorably influenced by amputation. Transection of the involved bone is not contraindicated provided it is above the upper limits of the lesion. As the patient outlives his lesion after curative therapy, the prognosis becomes progressively more favorable.

DANIEL H. LEVINTHAL, M.D.

Bereston, E. S., and Ney, C.: Squamous-Cell Carcinoma Arising in a Chronic Osteomyelitic Sinus Tract with Metastasis. *Arch. Surg.*, 1941, 43: 257.

Two cases are reported in each of which a squamous-cell carcinoma developed in a chronic osteomyelitic sinus. Each of these cases had metastasis, one to the lung and one to the pelvic bones. The authors review the literature of carcinoma arising in such sinuses. They find it occurs usually in men from forty to sixty years old, with a history of osteomyelitis and sinus formation of from twenty to thirty years' duration.

They also discuss the origin of this type of tumor. Early authors consider the carcinoma to be due to irritation of the skin about the sinus outlet. The possibility of the tumors' arising in the depth of the sinus because of the lining of the cavity with squamous epithelium, and the subsequent degeneration of this new epithelium are also discussed.

The favorable prognosis of this type of tumor has been emphasized and the rarity of metastatic lesions stressed. The authors could find only 4 cases in which metastatic lesions occurred in the viscera, and only 1 in which they occurred in the skin.

HAWTHORNE C. WALLACE, M.D.

Banks, S. W.: Aseptic Necrosis of the Femoral Head Following Traumatic Dislocation of the Hip. A Report of 9 Cases. *J. Bone & Joint Surg.*, 1941, 23: 753.

The recovery of a normal range of motion and freedom from pain, after the reduction of a traumatic dislocation of the hip and a short period of cast or traction immobilization, is generally interpreted as evidence of a complete recovery. In such instances, the patient is permitted to bear full weight on the limb and to return to his occupation with the understanding that he is cured. This encouraging prognosis is not a safe one, for many of these persons experience a recurrence of pain and progressive disability of the hip after months or, exceptionally, after years of normal activity and unchanged roentgenograms. This reappearance of symptoms after an early period of apparent recovery is now known to be due to aseptic necrosis of the head of the femur, which had resulted from disruption of a major portion of its blood supply at the time of the dislocation.

Forty-two cases of aseptic necrosis of the femoral head after traumatic dislocations of the hip are recorded as such in the literature. Thirty-five were in adults and 7 in children. The author wishes to add 9 additional cases, and in particular to emphasize the importance of early diagnosis in order that the devitalized head may be adequately protected from weight-bearing during its revascularization and replacement by new bone.

The incidence of this complication in dislocation of the hip cannot be definitely stated, for statistics of end-results are still not available on large series of cases.

Further study is required to evaluate the relative parts played by the various blood supplies as etiological factors in producing aseptic necrosis after hip dislocation.

The histological alterations in the head when it undergoes avascular necrosis and replacement following dislocation of the hip appear to be similar to those seen and confirmed by pathological examination in necrotic heads after fractures of the neck of the femur followed by bony union.

Osteo-arthritis is frequently superimposed upon the necrotic head, and this condition is characterized pathologically by a villous synovitis, acetabular sclerosis, marginal osteophytes, and occasionally the formation of loose bodies in the joint.

Necrosis following dislocation has been diagnosed mainly on the clinical course and roentgenographic appearance of the hip. It must be emphasized that while death of the femoral head occurs shortly after the dislocation, it cannot usually be detected by roentgenograms at the end of six weeks when the

patient is ready to resume walking. This is because the early roentgenographic diagnosis of a dead femoral head is dependent upon marked disuse atrophy of the adjacent living bone of the shaft and pelvis. Since the necrotic head without blood supply cannot participate in this decalcification, it will retain its original density and cast a shadow of greater intensity in the roentgenograms than will the surrounding living bone. Ordinarily, three to four months are required for sufficient atrophy to occur before this contrast between the living and dead bone is distinguishable in roentgenograms. As walking is usually resumed within six weeks of traumatic dislocation, there is insufficient time for density differences to develop between the dead head and the living shaft, and the complication temporarily goes unrecognized. The patient resumes full activity and continues to bear weight on the devitalized head until late changes, due to collapse or degenerative arthritis, cause the return of hip pain. This is usually the first clinical indication that epiphyseal necrosis has followed the dislocation. Roentgenograms will now show late evidence of necrosis, in the form of progressive replacement of avascular dense bone by less dense, irregular, living bone, alterations in the shape of the head following collapse or fragmentation, or signs of a deforming arthritis.

When the patient is not forewarned of the possibility of late pain in the hip, and continues to bear weight on the extremity for prolonged periods after the return of symptoms, the head may undergo marked collapse with depression of the articular surface, particularly at the points of maximum pressure. These changes are at times irreparable and result from compression of dead trabeculæ, or fractures through necrotic old or fragile new bone. Fractures are prone to occur through devitalized bone just proximal to the zone of transformation after a major portion of the head has been replaced and walking continues.

If such a fracture occurs, and the proximal dead fragment becomes reattached to the head, it may readily be invaded by connective tissue and replaced by new bone in a relatively short time. On the other hand, when non-union develops between the fractured fragment and the rest of the head, the former persists as a sequestrum at the top of the epiphysis for a prolonged period. The necrotic head may become greatly altered in shape, a fact which adds to the degree and length of disability.

Further evidence that unprotected walking on the devitalized head is responsible for the collapse and alterations in its contour is furnished by the observations in a case in which reposition of an iliac dislocation was not accomplished and, although the patient resumed walking on the limb, the shape of the head remained unmodified. This is to be explained by the fact that the superincumbent body weight was not transmitted directly onto the head through the medium of the acetabulum. This case is of additional interest because the necrotic central portion of the head had apparently remained unreplaced, and subsequently calcification occurred.

Traumatic dislocations of the hip are occasionally encountered in young children. Seven cases in which dislocations were followed by death of the femoral head have been recorded as such in the literature. The roentgenographic changes during replacement of the head appeared somewhat similar to those observed in Legg-Perthes' disease, and the immediate end-results were equally satisfactory. The osseous center underwent necrosis with subsequent invasion and transformation.

When the femoral head in older children becomes necrotic, the pathological alterations simulate those seen in adults and the results are equally poor. This appears to be true whether the primary pathological condition was a traumatic dislocation, a fracture of the neck of the femur, or a slipping of the upper femoral epiphysis.

Any patient who sustains a traumatic dislocation of the hip may develop late changes in it because of aseptic necrosis of the femoral head. Of the 43 recorded cases in older children and adults, 39 have resulted in deformed and painful or ankylosed hips. In each of these instances, the head had undergone extensive collapse or fragmentation before the patient returned for medical care after the period of apparent recovery, or before the primary pathological condition was recognized. This demonstrates the importance of early diagnosis, and the necessity for adequate protection of the fragile, devitalized head during its restitution, if the prognosis in these cases is to be improved. Since the presence of a dead head cannot usually be detected soon after the initial injury, either by clinical or roentgenographic examination, the physician may approach the problem of early diagnosis in one of two ways, as follows:

Whenever possible, the extremity may be protected from weight-bearing by means of crutches for from four to six months after the period of immobilization or recumbency. If the femoral head undergoes uniform atrophy of disuse and no density difference develops between it and the then osteoporotic living bone of the shaft and the ilium as shown by roentgenograms, the patient may resume full weight-bearing with the likelihood that the head has remained alive, although roentgenographic follow-up should continue for an additional twelve months. However, if the head is shown to be necrotic, early protection can be provided and continued until serial roentgenograms show final revascularization and replacement by new bone.

On the other hand, if the patient insists on walking six weeks after the dislocation without the aid of crutches, roentgenographic examination of the hip must be obtained at intervals over a period of at least two years, although the extremity may appear clinically intact. When the diagnosis is clear before much damage to the head has occurred, weight-bearing should be prevented until replacement has been completed. If, however, the hip is already the

site of a marked deforming arthritis which precludes the possibility of a satisfactory outcome, an arthrodesis appears to be indicated.

While the end-results have been almost uniformly bad in adults and older children, the outcome has been gratifying in 8 young children in whom a traumatic dislocation of the hip was followed by aseptic necrosis of the femoral head.

Numerous roentgenograms of the author's cases, and reports with a summary chart of the cases recorded in the literature are presented.

ROBERT P. MONTGOMERY, M.D.

Kite, J. H.: Congenital Pseudarthrosis of the Tibia and Fibula; Report of 15 Cases. *South. M. J.*, 1941, 34: 1021.

Occasionally the tibia is found to have a pseudarthrosis at birth, but this fracture behaves entirely differently from those fractures produced during delivery. Of the 15 cases studied, only 1 showed a fracture at the time of delivery.

It is a congenital condition, in that the children are born with an abnormality of the tibia, but this condition is not inherited. Before it has fractured the tibia shows an anterior and lateral bowing, with the lower half of the shaft smaller and more dense, and at times cystic. Certain of the bone elements have entirely lost their power to reproduce bone. In fact, it seems that there is present a hyperactivity of the bone-destroying elements.

These tibias present pseudocystlike areas, which are often unilocular, and which may enlarge, coalesce, or disappear entirely. Bones are not static, but are in a constant state of flux. This is true for the pseudarthrotic as well as for normal bones. Roentgenograms made from time to time show al-

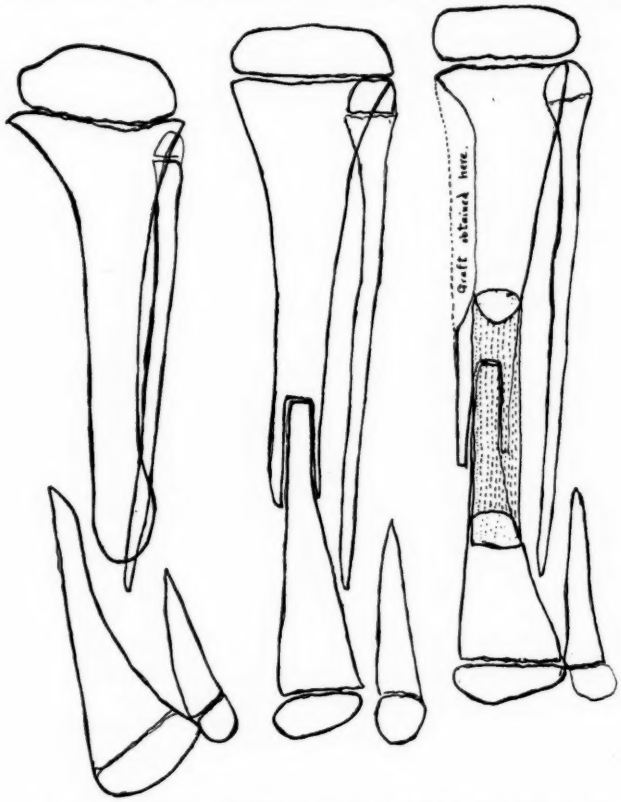

Fig. 1. Drawing to illustrate the "bone flap onlay" graft used. The lower fragment was mortised into the upper fragment. The medullary canal was opened. An onlay graft was obtained from the upper end of the same tibia, and was placed across the point of fracture. Each end was slipped under the bone flaps raised from each fragment, which gave firm contact and good immobilization.

most constant changes in these vacuolated areas. The cysts may appear in any part of the bone. When they are near the junction of the middle and lower thirds of the tibia, a fracture may occur following very slight trauma. It seems that the process which is destroying bone and producing the cyst continues to be active. Callus is prevented from forming, and the bone ends gradually become smaller in diameter and more dense. In every case in this series the distal end of the proximal fragment became more or less concave and the proximal end of the distal fragment became pointed.

This condition is typical both clinically and in the roentgenogram. An effort should be made to recognize it, as it may save embarrassment some day. If the bowing of this condition is mistaken for rickets and an operation is done to correct the deformity, the chances are that non-union will follow. In 3 patients in this series, this mistake was made elsewhere and all of the operations resulted in non-union.

The tibia usually fractures at the junction of the middle and lower thirds and the fibula at a slightly lower level.

The incidence of occurrence was 0.2 per cent. There was equal distribution regarding sex and the side upon which the fractures occurred.

In only 1 case was the fracture noticed at the time of delivery. More than half of the fractures occurred during the first year of life. One-fourth of them occurred before the children reached their second birthday, while 3 of the fractures did not occur until the children were six, seven and eight years old.

Thirteen of the 15 patients in the author's series have been operated upon. One patient is being observed in a pre-fracture state and 1 has refused operation. The 13 patients that submitted to operation had 28 operations. Thirteen operations resulted in non-unions, 14 in bony union, and 1 is too recent to report. Various types of bone grafts and fixations have been used. The best results were obtained by the use of a "boneflap-onlay" or a "sliding-end-under-boneflap-onlay" graft. Union occurred in 7 of 8 cases.

In addition to this type of bone graft the medullary canal is opened by drilling a row of small holes in the anterior cortex and cutting the bone out between these holes with a thin osteotome. In this way the fragments are not fractured. Often they can be mortised together to give additional support. After the graft has been placed, curettesful of medullary bone from the donor area are packed about the bone ends and the graft. Any additional small bone shavings available are packed about the point of the fracture. The periosteum can be closed over the ends of the graft, but along the middle only muscles can be brought over the bone. The graft is usually placed on the side of the tibia next to the fibula, so that it is buried deep beneath the muscles, which gives it a better blood supply.

All deformity must be carefully corrected before the graft is inserted. If this is not done weight-bearing will produce a stress on the bone which may

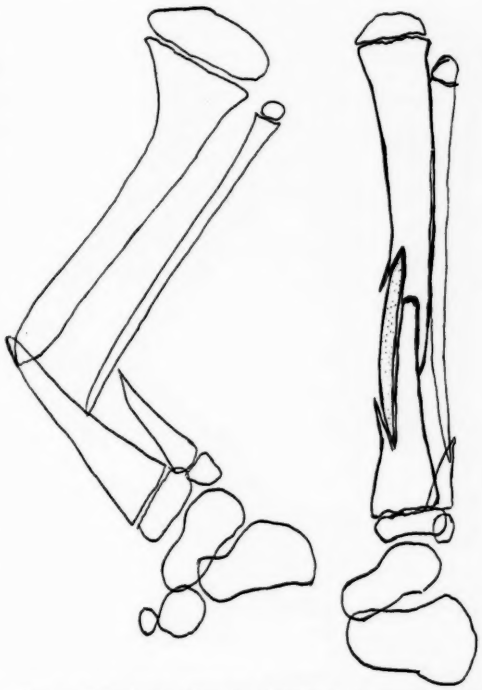

Fig. 2. Drawing to show the details of the operation in the anterior posterior view. The lower fragment was mortised into the upper fragment. The onlay graft cut from the upper end of the tibia was placed across the fracture line and the ends slipped under the bone flaps turned up from each fragment.

favor resorption of the grafted area. In small children the cast is continued up on the body as a spica.

If union is going to take place it will be present when the first cast is changed at the end of from six to ten weeks. Those cases not showing union have all been immobilized longer, with the hope for union. One case, which showed non-union at the upper end of the graft, united after eight months in casts. The patient still has good union twelve years after the bone-graft operation.

The patients were kept flat in bed without weight-bearing for about three months and then let up with a cast and walking iron. The average time in casts for the entire series was nine and seven-tenths months. A snug-fitting brace was then applied. The author describes and includes pictures of a brace that he regards as necessary for adequate protection of the leg following the removal of the cast.

All of the children who have pseudarthrosis of the tibia and fibula have a great deal of shortening by the time they are grown, so that the leg is never so good as might be desired, even though firm union has been obtained. The earlier the union is obtained,

the less the shortening. The average shortening for 6 of these patients who have reached the age of sixteen is 10 cm.

An amputation would be the most economical treatment, but is not the best orthopedic surgery. The author believes that a living foot below par is better than a wooden foot, which many of these patients are not financially able to replace when a new one is needed. Of the 13 cases operated upon, 1 of the earlier patients in the series left with a nonunion and did not return. One operation is too recent to be sure of the result. This gives 11 cases with good union at this time, which justifies the continuation of bone-grafting operations.

ROBERT P. MONTGOMERY, M.D.

FRACTURES AND DISLOCATIONS

Hellner, H.: The Present Status of the Operative Treatment of Fractures (Der heutige Stand der operativen Frakturenbehandlung). *Med. Welt*, 1941, p. 110.

Today the routine treatment for compound fractures of bones is operative, even though there may be only a slight piercing of the skin. These cases belong to the specialist in surgery, but they must come to him within six or eight hours, otherwise he can no longer change the compound fracture into a closed one by surgical care of the wound. Beyond this limit of hours suturing must not be done as a rule. However, even within this period it requires great experience to decide whether suturing should be done or not. An insufficient cleansing of the wound is worse than none at all. It is taken for granted that the instruments must be changed when attacking different layers of tissue. Divided nerves should be sutured, if necessary, with shortening of the bones. There should be few subcutaneous sutures. The skin sutures should be loose. With defects of skin, shifted flaps should be applied; the bridge plastics are the best. All of these measures aim to prevent infection. At first there is no necessity for a good reduction of the bone fragments. In transverse fractures the fragments can sometimes be adjusted with the one-pronged hook. No wires should be used nor should wire be twisted around the bone. The plaster cast should be windowed, split longitudinally, or shell-shaped. Tetanus serum should be given in every case.

Similar conditions prevail with gunshot fractures, but those produced by projectiles of small caliber should be treated purely conservatively, while the others should not be sutured in spite of wound care within the eight-hour period. Extension apparatus should not be applied during a mobile war. Nor should the patient—in case air transport is used—be immediately transported to the rear; he should be held a week for observation in view of the possible outbreak of infection. Gunshot fractures with ruptures of main arteries and larger nerves are cases for amputation, as are also the severely infected gunshot fractures untreated for several days. The results of the operative treatment of compound fractures are good. Three-fourths of them have a smooth, uncomplicated course.

In contrast to this, in general, simple fractures of bone should fundamentally be treated conservatively. No simple fracture of bone which can be reduced and maintained with conservative measures should be treated operatively. However, not every fracture can be reduced. In fractures of the shaft a lateral displacement of a half or the entire breadth of the shaft does no harm, provided the axes remain parallel. As a rule they should rarely be operated upon. Of 400 fractures of the femur, Boehler had to operate on only 1. The same applies to fractures of the leg. Even most of the fractures of the forearm can be well reduced by wire traction. Because of the advance in technique fewer simple fractures of bones are operated upon today. If an operation is performed, the skin must be intact and exudates of blood must be aspirated. At the author's clinic the Kirschner instrumentarium is used with rustless steel plates. The screws are inserted up to the cortex of the opposite side. Only oblique fractures are suitable for the twisting of wire around the bone. Displacements of articular surfaces, such as fractures of the tibial head, bimalleolar fractures of the ankle with twisting of the fragments, and condylar fractures at the elbow-joint, should also be treated surgically. In fractures of the head of the radius with marked displacement it is best to remove the head. There is also an indication for operation in fractures of bones from muscular traction. However, fractures of the patella should be operated upon only in cases in which the reserve extension apparatus is also ruptured. Of the fractures of the middle portion of the femoral neck, those in the position of abduction and with good impaction are not operated upon. On the other hand, those in the position of adduction with a varus position and shortening are usually operated upon, and this is done extra-articularly. Nevertheless, the author does not believe that nails should be used. The advantages are the lesser mortality, the better results, and the patient's leaving the bed after fourteen days as compared with plaster-cast treatment in which the patient remains in bed for six months. However, the operation has the disadvantages of loosening the nail, pseudarthrosis, coxa-vara formation, and necrosis of the head.

The other subjects called into question are dislocation-fractures of the upper arm, fractures of the shaft of the humerus with radial paralysis, compression fractures of the skull, and vertebral fractures with incomplete paralyses.

(FRANZ). LOUIS NEUWELT, M.D.

Soto-Hall, R., and Haldeman, K. O.: The Conservative and Operative Treatment of Fractures of the Carpal Scaphoid (Navicular). *J. Bone & Joint Surg.*, 1941, 23: 841.

Carpal navicular fractures are prominent in current medical literature because of their known proclivities to cause prolonged disability. There is

much variety of operative methods which may be used in the treatment of non-union of the navicular bone. The authors present the end-results of a group of acute fractures treated conservatively and also evaluate the various operative measures used in the treatment of non-union. The age of the patients treated ranged from ten to sixty years, with a total of 50 patients.

In 1934 the authors described the conservative treatment of 16 cases of fractures of the carpal navicular of which 12 had bony union. Since that time (eight years) the above 50 additional patients were seen. Of these, 47 were males and 3 females. This preponderance of males is attributed to the large proportion of industrial injuries. The maximal incidence occurred during the third and fourth decades of life. The duration of these fractures, at the time first seen, permitted one-half of them to be treated conservatively. The high incidence of fractures through the wrist allows considerable uniformity in their treatment. Associated injuries (such as dislocation of the lunate which is most common) alter the type of treatment.

Success in treatment of the fractured carpal navicular bone depends upon early recognition of the fracture and a complete and prolonged immobilization of the fragments.

Of the factors concerned in non-union, the arterial blood supply is of much importance. Aseptic necrosis, seen most frequently in small proximal fragments, and the absence of periosteum are both obstacles to healing.

Microscopic sections of 5 surgically excised naviculars show a characteristic fusiform area of absorption which occurs along the line of fracture when the navicular bone has not been adequately mobilized. The bone disappears and is replaced by fibrous connective tissue near the center of the fracture. Microscopically, the hyaline cartilage does not regenerate.

The most important causes of non-union are ineffectual or insufficiently prolonged immobilization and failure in early diagnosis.

It is emphasized that negative roentgenographic examination immediately after injury does not rule out a fracture and that if clinical signs point to a fracture the patient should be treated as though the diagnosis were definitely made; the roentgenographic examination repeated at the end of three weeks often will give the true diagnosis because of absorption of bone along the line of fracture.

Classification of navicular fracture should be anatomical and chronological. Anatomically there are fractures of the body, through the waist, the proximal pole, the tubercle, and comminuted fractures. Chronologically they are grouped as recent (up to two weeks) and old.

Immobilization of the wrist in a cast should be in the position of full radial flexion and 30 degrees of dorsiflexion with the thumb in full abduction and extension. The thumb must be forced into abduction by pressure on the base. The total immobilization time of the wrist is from three to six months; the thumb may be released after six weeks. Marked comminution is one indication for excision of the fragments.

As to the authors' experience, healing is found to be slow following drilling and osseous union occurs in only one-half of the cases. They therefore introduce one or two bone grafts after excision of all interposed fibrous tissue and drilling of the fragments.

LEO MARKIN, M.D.

Geissendoerfer, H.: Successful Treatment of Old Fractures of the Os Naviculare of the Hand with Nails (Erfolgreiche Behandlung veralteter Kahnbeinbrueche der Hand durch Nagelung). *Zentralbl. f. Chir.*, 1941, p. 343.

The usual treatment by immobilization over a long period of time with a plaster-of-Paris cast was successful in only a few cases. The same may be said about the medicomechanical management. Opinions are divided concerning the successes attending operative removal, if possible, of the smaller bits of fracture fragments. Beck's drilling operation seems to be promising. Westerman reported successes following this treatment a small number of selected cases.

The failures are understood when one realizes that these small bone structures are covered in very few places with periosteum and therefore periosteal bone regeneration is almost out of the question. And when, in addition, the endosteum is damaged by bored holes, and the vessels are damaged, besides, the healing possibilities become increasingly smaller. In America the use of the bone peg is preferred. Virchow has proved that the anatomical state makes the healing much more difficult, because there is fixation on the one side to the trapezium, and on the other side to the os naviculare. The movement of the hand, and especially of the fingers, places the ligaments in action in opposing directions. In so doing there is a scissors-like action which results in an added destructive influence. Therefore, absolute immobilization of the involved part is a most important requisite.

Geissendoerfer fulfilled this condition with the use of a Kirschner wire (1.3 to 1.6 mm. strength) shortened to 6 cm., and hammered in under local anesthesia, with the aid of fluoroscopy, through the tuberosities of the navicular bone up to the ulnar prominence; and then he put on a circular plaster bandage up to the metacarpal articulations. The bandage was left undisturbed for from eight to ten weeks. Then followed its removal, a roentgen-ray check-up, and a new plaster bandage for the following four weeks. For three to four weeks following this, the hand was strapped, in addition, with an elastic bandage. Six cases were handled in this manner. The youngest patient was four months old, the others were between nine and fourteen months. There was roentgenological and clinical healing and no limitation of movement.

(PLENZ). H. H. GROSKLOSS, M.D.

ORTHOPEDICS IN GENERAL

Lange, M.: Muscle and Tendon Injuries Due to Sports (Muskel-und Sehnenschaeden beim Sport). *Zentralbl. f. Chir.*, 1941, p. 438.

Muscle cramps run parallel to the fibers of the muscle; muscle tears, transversely. An electrical study of the muscle is worthwhile because it gives an understanding of the muscle. Infectious rheumatism, typhus, and even early tabes favor muscle tears. According to Baetzner an athletic injury or an injury to an elderly person presupposes a muscle injury. Maydl assumes that a disturbance in co-ordination predisposes to a tear in a sound muscle. This may start from fatigue, either central in the brain or peripheral in the affected muscle. Therefore, an unequal response occurs with one-sided opposition of the muscle. According to Payr, this signifies that the harmony of kinetic energy has become lost. In the trunk one finds muscle tears in the trapezius and the rhomboids. Abdominal muscle tears are more frequent in the large muscles. In these cases, suspicion of a tear of the epigastric artery or of strangulation of a hernia make operation imperative. A quadriceps tear is a serious sports injury. The rectus is more frequently affected than the vasti. In early cases a simple suture of the muscle suffices in most cases; in old cases bridging over with mercury-oxycyanate silk and interlacing of the muscle ends is necessary. Kuettner calls the tears of the triceps suræ the "tennis bone." Muscle cramp is caused by the products of fatigue, primarily through saturation of the muscle with muscle lactic acid. Massage, especially, and warm applications bring healing. Athletic injuries also cause corresponding injuries of the tendons, together with tendon-sheath inflammation. In the case of the Achilles tendon there occurs, according to Hohmann, a paratendonitis. Extensor tendon tears about the second to fifth fingers affect the tendons themselves or the extensor aponeurosis. The treatment is conservative and consists of immobilization for from four to six weeks by placing the hand in hyperextension. The extensor-tendon tears of the thumb are due to overstraining, especially in drummers. Horseback riders occasionally tear the long flexor tendon of the thumb. The treatment consists of suturing the tendon. If proliferation of the joint rim of the glenoid cavity of the scapula is present, it can wear through the biceps tendon. A tendon tear of the inferior end of the biceps requires a powerful force. In tendon tears of the upper biceps tendon, the short head takes the strain, between the brachioradialis and the brachialis internus. Flexion is only possible in pronation, therefore reuniting of the ragged tendon end with the tubercle of the radius by means of a short tendon suture is advisable. Operative procedures for quadriceps and Achilles tendon tears are described with full particulars, and made clear by illustrations.

(Plenz). Marian Barnes, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Wildegans, H.: Arteriography in Traumatic Aneurysms (Die Arteriographie bei traumatischen Aneurysmen). *Chirurg.*, 1941, 13: 6.

This is a very valuable contribution because it restores the prestige of vascular suture which prestige had been given to ligature. During the period before the war, some well known surgeons, as for example Sauerbruch, were definitely in favor of ligature. Even Stich preferred the latter provided conditions indicated complete functional restoration of the limbs, but he emphasized the fact that one could never be certain that necroses would not develop. Ruettner, von Haberer and Bier, on the other hand, remained convinced devotees of suture. Wildegans has now for the first time emphasized the advantages of arteriography in war surgery, (1) for the purpose of demonstrating the site and origin of the aneurysm, (2) to obtain information regarding the collateral circulation, and (3) to ascertain how the suture functions later on. He observed 55 aneurysms and described in detail a few striking cases. By direct contrast-filling with uroselectan of the aneurysmal branch it is easy to judge the distention of the adjoining collaterals. In the intra-arterial types of aneurysm one frequently finds at the site of filling of the duct only a delineation of the space in which the blood whorl takes place with a tortuous superposition of the injured artery.

In his 7 reported cases there is 1 case of aneurysm of the popliteal artery, 1 of the ramus perforans of the deep femoral artery (which was first assumed clinically to be an aneurysm of the femoral or profunda artery), 1 case of arteriovenous aneurysm of the femoral artery which had been present for twenty-five years, 1 case of aneurysm of the common carotid artery, 2 cases of aneurysm of the brachial artery, and 1 case of aneurysm of the creosum branch of the femoral artery. He used ligature only for the aneurysm of the ramus perforans, lateral suture in 3 cases and circular suture in the 3 other cases. Of special interest was the arteriovenous aneurysm of the femoral artery which had been present for twenty-five years. The thigh was markedly swollen, the leg atrophic with deep scars, ulcers, and a flexion contracture of the knee. No pulse could be demonstrated in the tibialis postica and dorsalis pedii. The heart showed some enlargement only on the left side, with mitral stenosis and mitral insufficiency. Operation revealed, as had already been demonstrated in the arteriogram, a marked tortuosity of the artery, which was about as thick as the middle finger. The femoral vein was twice the width of the thumb. The vein and artery intersected throughout the entire area. There was a broad arteriovenous fistula in Hunter's canal, with a saccular dilatation of the artery (aneurysm verum!) above the marked stenosis at the site of the fistula. Resection of the fistula was done, which was followed by double ligature of the vein. Circular suture of the artery resulted in good permeability of the artery.

There was still another interesting case, one of an arterial aneurysm, the size of a hen's egg, of the common carotid artery, just below the site of bifurcation. Operation was done after one month. It consisted of resection of the artery and circular suture, which was followed by ligation of the internal jugular vein. Some hours after the operation there were loss of consciousness and convulsions. Death occurred on the following day. The autopsy showed that the site of suture was smoothly permeable, and with no thrombus. There was a beginning dilatation in the temporal lobe. It was assumed that the compression of the carotid artery, which had been effective for one and one-quarter hours was the cause of the circulatory disturbance. No circulatory disturbances were noted in the other cases sutured by Wildegans. The permeability was later confirmed by arteriograms. The article contains 16 illustrations. (Franz). Edith Schanche Moore.

BLOOD; TRANSFUSION

Tocantins, L. M., O'Neill, J. F., and Jones, H. W.: Infusions of Blood Via the Bone Marrow. *J. Am. M. Ass.*, 1941, 117: 1229.

The problem of administering fluids to infants is a difficult one, especially when rapid absorption is desired. The two main routes available, aside from the peripheral veins themselves, are the superior longitudinal sinus, reached through the anterior fontanel, and the peritoneal cavity. Infusion through the anterior fontanel, unless in skilled hands, is attended by a high risk. The absorption of substances injected intraperitoneally may be greatly delayed. Thus there remains a group of infants for whom infusion by the intramedullary route may be the only advisable resort. Substances injected into the marrow cavity are rapidly taken up, apparently unchanged, into the general circulation. These considerations led to a trial of the merits of the intramedullary route for the infusion of fluids.

The authors' experience with the intramedullary infusion of fluids in infants has not been extensive enough for a clear delineation of its field of usefulness and the drawbacks. The method is indicated chiefly when rapid absorption is necessary and the intravenous route is undesirable or the veins are unavailable. This method of infusion may be utilized in states of shock, during convulsive seizures, when wide-spread edema exists, in burn cases, or when the anterior fontanel is closed and the veins poorly developed. The method is offered not with the intention of replacing the intravenous route but rather as a supplement.

The method would seem contraindicated in cases of severe systemic infection associated with bacteriemia, septicemia, or osteomyelitis. The danger of embolism appears rather remote. Citrated blood and the physiological solution of sodium chloride were infused through the marrow of a tibia or a femur of 9 infants in whose treatment intravenous infusions were urgent but impossible. In 2 children with congenital anemia and erythroblastosis, it was not possible to infuse any blood by this method. No local or constitutional reactions have been observed. When clearly indicated, the intramedullary route for parenteral therapy is feasible and useful.

JOHN W. NUZUM, M.D.

Smith, J.: The Case for Transfusion of Unmodified Blood. *Med. J. Australia*, 1941, 2: 286.

The outbreak of World War II suggested to the author the restoration of direct transfusion as an adjunct to the established methods. At first he used the syringe methods; then the principle of roller compression of a rubber tube was adopted to activate a continuous flow of blood from donor to recipient. The rotary transfusion pump will transfuse a pint of blood in about six minutes' time. The transit time from arm to arm is under ten seconds. In this article the technique employed is set forth. The pump has been used by the author in more than 100 cases.

The pump is so constructed that rollers attached to a handle compress the tubing against the well wall and obliterate the lumen serially. A continuous milking action takes place and a steady flow of the tube content is created. The standard red-ribbed rubber tubing is used. The size of the wall is so designed that ten revolutions cause a flow of 1 oz. of fluid with this tubing. Two hundred revolutions represent a total output of 1 pt. A counting ring is designed as a part of the machine.

The writer observed the result of unmodified blood transfusion in many people suffering from blood dyscrasias. In recurrent hemorrhage, chiefly from peptic ulcer, when unmodified blood was used alone, hemorrhage ceased after a single transfusion in almost all instances. In the cases in which bleeding continued after citrated blood was used repeatedly, the resort to unmodified blood was successful in arresting the hemorrhage. The conclusion is that when some ulcers bleed and others do not, in those patients who bleed there is perhaps a slow clotting time and a low platelet count. For these, unmodified blood should certainly be used and the citrated solution should be avoided.

Although it has been said that the rapid introduction of a pint or more of blood by direct transfusion will unduly raise the blood pressure and displace a clot, the author has found that no rise of blood pressure occurs above a very low normal; certainly the pulse increases in volume and the rate tends to slow down, but the objection of clot displacement must be laid aside by the urgency of the other considerations.

The strong contrast in pattern between the two methods of transfusion is described. Direct transfusion assumes the character of a minor operation. The time taken up with preliminaries may be put down at under an hour if the blood-matching is included, but the actual transfusion takes about six minutes, and the patient is spared the inconvenience of drip transfusion which requires constant nursing supervision. Another objection to direct transfusion is the psychological disadvantage due to proximity of donor and recipient. The question arises whether there is danger from the speed of the transfusion. In this series no patient has shown distress from this cause. For this consideration the cases fall into two classes. The first includes all those of more or less severe hemorrhage of short duration, in which there is presumably an appreciable fall in the total blood volume. In the cases in which there presumably was not an appreciable fall in the total blood volume, such as those of chronic anemia and blood dyscrasias, there was a surprising absence of cardiac or pulmonary distress. The commonest effect was a feeling of general flush, most noticeable in the face. The author concludes with the statement that no case of heart or renal disease was included in the series.

HERBERT F. THURSTON, M.D.

SURGICAL TECHNIQUE

WAR SURGERY

Johnson, L. W.: An Experiment in Hospital Mobility. *War Med.*, 1941, 1: 646.

The purpose of the experiment was to set up a hospital as mobile as the naval military units it was required to serve. Accordingly, a 500-bed test unit was prepared, in which methods, supplies, equipment, transportation, organization, and administration could be developed and evaluated. The transport, known as the U. S. Naval Mobile Hospital No. 1, was manned by a force of over 200 men, and carried 600 tons of materials occupying 135,000 cubic feet. The experiment was conducted in the Caribbean area.

While any degree of mobility could be achieved by choosing suitable equipment, the arrangement of having a fixed portion at the base from which a mobile unit could be sent out to accompany an expeditionary force proved most useful. Patients from such "mobilette" could be evacuated to the base hospital by plane if necessary. An excellent opportunity was provided to compare tents with prefabricated buildings for wards, offices, and quarters. While the latter are portable as they come from the factory, they cannot be taken down again and moved once they are set up without serious damage; yet they were found to be desirable because they protected the patient from heat, cold, wind, dust, and insects, and they greatly facilitated nursing care. They are more economical because they do not deteriorate as rapidly as tents do. Concrete is more valuable for foundations than wood. Various power sources were tried out and the final conclusion was that one should try to have everything run by a single fuel, a fuel that would always be available in the area served by the hospital. So far as possible, all lighting and all machines should be run by electricity. By this means the fire hazard is reduced. The total power load should be figured to give ample margin for overloads and standby service.

The commissary is very important because it exerts a profound influence not only over the physical welfare of the patients, but also over the morale of the whole staff. The equipment should be well planned, electrified as much as possible, and tested before shipment while actually operating.

The surgical service is often the first service needed when the hospital is set up. Surgical equipment and supplies should be plainly marked so that they can be identified as they are unloaded. Prefabricated buildings proved most satisfactory for the surgical unit. Proper transportation and maintenance supplies should be provided in adequate numbers. The supplies and equipment should be selected only after full consideration of the type of service the hospital is to render and what degree of mobility it must have. Methods of packing, careful and plain markings for rapid identification, size and weight of the containers, a large and varied supply of tools, each contribute to the success of the properly functioning unit. Again it is stressed that all machinery should be inspected before shipment, while actually operating.

EDWIN J. PULASKI, M.D.

Boehler, L.: War Surgery and the Isolation Hospital (Kriegschirurgie und Sonderlazarette). *Wien. klin. Wchnschr.*, 1941, 1:29.

This article is a very significant piece of work resulting from a great number of war and peace experiences of recognized Vienna accident surgeons; it is of special value for war hospital organization as it clearly shows the advantage of maintaining an isolation hospital for gunshot injuries of the bones and joints. Some points of special significance can be derived from the general preferatory notes: emphasis on the fact that retention sutures are seldom needed, and that the wounded should not be undressed. Boehler is also an adherent of the use of tetanus prophylaxis in war, as contrasted to peace, because in war débridement of the wounds cannot be done as carefully as in peacetimes. He has observed no employment of gas-gangrene serum. He objects to primary suture under conditions of war. He advocates early amputation in cases of complete interruption of the blood supply to a part.

All, including wounds of the soft parts, should be placed at absolute rest. The first transport dressings are fundamentally different from the various medical dressings. The plaster-of-Paris dressings must be well supported. Various types of bandages are then presented for the various hospital stations. The upper-arm fractures should be immobilized with a Desault or with a triangle, not with an abduction, splint, which is an impediment to transit. Leg fractures should be fixed to their fellow or with a transport extension splint. The latter should be used for only short transports. If one uses either a wire or a wooden splint the external splint should extend as high up as the axilla. Lower leg and foot fractures should be placed in a metal boot with a transverse base to prevent overturning. It is the rule not to search for shot splinters. A warning may be offered concerning splinters: the French medical reports disclose that of the 37,746 femoral fractures, 10,908, or 28.9 per cent, subsequently had to be amputated because they were rendered unserviceable in consequence of large bony defects. Elastic drainage tubes should not be drawn through the interosseous space in the lower arm and the lower leg because of the danger of erosion bleeding. The flap, and not the circular, type of amputation should be employed. The amputation must not demand more than ten minutes of narcotization.

In the case of femoral gunshot fractures with extensive wounds and transection of the ischiadic

nerve, or with wide opening of the kneejoint, amputation should be carried out early. No suture of the amputation wound should be done. Benign cellulitis with gas formation and pus is compared with true aerobic infection without pus formation and with the sudden onset of severe pain, increasing pallor, and quickening of the pulse. Extension dressings should not be applied at the front hospital unit because with them the wounded cannot be brought into an air-raid cellar in the case of an air-raid alarm. An unsupported plaster-of-Paris dressing may first be employed for a short transport and when the infection has receded. It must always be split inside and out; in order that either the front or back half of the gutter can be removed for the purpose of changing the dressings without danger to the fixation.

Attention is directed to the failure of removing the wounded with gunshot injuries of the bones and joints gradually homeward. They should be transported as soon as possible to the isolation hospital. This hospital should contain at least 500 beds and be erected in a place free from the danger of air-raids. This arrangement alone renders faster and better healing possible. The furnishing of this hospital with especially simple facilities is described. It is advisable that each transport plaster-of-Paris dressing bear a record of the type of bony fracture enclosed.

Gunshot fractures of bones and gunshot injuries to joints constitute 25 per cent of all wounds; they accounted for 90 per cent of all the severe injuries and 81 per cent of the permanent invalids of the World War.

Reference is made to the good results of Jimeno Vidal and Arguelles in the Spanish Civil War with these isolation hospitals. Boehler gives numerous tables, to be read in the original article and deserving of separate study, with the number of cases attended by him during the World War and his results. He treated in all 777 gunshot fractures and gunshot wounds of the joints, with a mortality of 3.6 per cent and an incidence of amputation of 1.6 per cent. Infection was present in 85 per cent of the gunshot fractures and in 79 per cent of the gunshot injuries to the joints. Special emphasis was placed on the gunshot fractures of the femur and gunshot injuries of the kneejoint. Of 111 gunshot fractures of the femur, 13, or 11.7 per cent terminated fatally; 7 because of hemorrhage, 5 because of sepsis, and 1 because of empyema.

Of the 7 cases with hemorrhage 3 were saved through excellent management; of the 5 which developed sepsis 4 were carried through by reason of opportune amputation. Amputation was required in 3 patients, or 2.7 per cent. Seventy-three patients were healed without suffering any shortening; 16 had shortening from zero to 1 cm., 17 with 1 to 2 cm., 3 from 2 to 3 cm., and 2 with 4 cm. Free motion was present in the kneejoint in 24 patients, motion of over 90 degrees in 33, from 60 to 90 degrees in 19, from 40 to 60 degrees in 10, from 30 to 40 degrees in 4, 20 degrees in 2, and 3 of the injured suffered ankylosis. Pes equinus and pressure ulcer of the heel occurred in no instance. Ten or 15.6 per cent of the 64 patients with gunshot injury to the kneejoint died, 2 from hemorrhage, 5 from sepsis, and 2 from aerobic infection. The 5 cases of sepsis could have been avoided through timely amputation. Six or 9.4 per cent required amputation. Free motion was afforded 13 times; in 5 instances the motion was over 90 degrees, in 6 between 60 and 90 degrees, and in 9 between 20 and 50 degrees, and in 15 cases fixation in mild favorable flexion was obtained. Boehler gives the precise results in the other fractures and joint wounds.

As proof of the advantages, even in times of peace, of executing the management of such injuries in an isolation hospital, Boehler presents a table. Inside the hospital the average time under treatment was two hundred and forty days and outside it was three hundred and ninety days; of the first-mentioned group of patients 10.2 per cent, and of the second group 22.6 per cent, drew a permanent pension; the first group missed six hundred and twenty-seven working days and the second missed one thousand eight hundred and nineteen working days. In conclusion, Boehler presents a table comparing gunshot fractures of the humerus to those of the femur.

TABLE I.—GUNSHOT FRACTURES OF THE HUMERUS AND OF THE FEMUR

	Number of cases	Mortality %	Amputations %	Survivals without amputation %
Gunshot fractures of the humerus				
American Medical Report	3549	8.5	14.3	77.2
French Medical Report	50097	4.6	15.6	79.8
German Composite statistics	504	5.5	11.0	83.5
Isolation Hospitals				
Boehler (World War)	197	2.0	—	98.0
Arguelles (Span. War 1936–39)	214	2.3	0.9	96.8
Jimeno Vidal (Span. War)	963	0.6	0.2	99.2
Gunshot fractures of the femur				
American Medical Report	3296	24.4	36.7	38.9
French Medical Report	37746	13.7	28.9	57.4
German Composite statistics	1675	23.3	12.5	64.2
Isolation Hospitals				
Boehler (World War 1914–18)	111	10.8	2.7	86.5
Arguelles (Span. War)	316	8.9	7.2	83.9
Jimeno Vidal (Span. War)	600	3.6	1.6	94.8

To be noted is the fact that the French medical reports concern only the intermediate and base hospitals; further, that Arguelles and Vidal follow perfectly after the Boehler fundamentals. The social consequences of such favorable healing results are

evident from the statistics regarding the number of war invalids and ill who are entitled to receive pensions. Of these there were in Germany after the World War 1,537,000; in France 1,500,000; in Italy 800,000; in Russia 735,000; in Poland 320,000; in Czechoslovakia 236,000; in Jugoslavia 164,000; in the United States 157,000; in England 117,000; in Rumania 100,000; and in Belgium 50,000. The original article contains thirty-seven illustrations.

(FRANZ). H. H. GROSKLOSS, M.D.

Ernst, M.: Duties and Problems in War Surgery at Field Hospitals (Kriegschirurgische Aufgaben und Probleme im Einsatz). *Muenchen. med. Wchnschr.*, 1941, 1: 209.

The author discusses the difficulties which confront the surgeon in the front line field hospital. The present war differs from the World War in that the rapidly moving field hospital does not allow regular hospital conditions. The author stresses the fact that the World War produced similar conditions in cases of rapid offensives; for instance in the push to the Marne during the World War, the break through the Russian lines between Tarnow and Gorlice to the Pripet Swamps, the Brussilow offensive, and the Serbian and Rumanian campaigns. In these, too, first aid at the field hospital at times lasted only a few hours or days under very primitive conditions.

The author points out the responsibility of the surgeon whose task it is to sort out the wounded upon their arrival. The patients who require surgical intervention often have to wait a long time for their turn. It is a mistake to remove them from the stretcher or to undress them. This should be done in the operating room under supervision of the surgeon. Naturally, the cleanliness and asepsis of the room is impaired. The field sterilizing apparatus is too small to take care of a sufficient quantity of surgical linen; therefore, an ample supply should be kept on hand. The absence of a rubber apron outfit for the surgeon and his assistants was felt very keenly. The white operating coats are less practical; they become stained with blood very quickly, while the rubber apron can be washed. In peacetimes, rubber gloves are considered absolutely necessary only in case of septic operations in order to keep the hands as germ-free as possible. At the front, however, the wounds are recent and non-purulent. In front-line field hospitals gloves should be used particularly for aseptic operations on the skull, chest, and abdominal cavities. Base hospitals offer facilities for all operations.

Should patients in a state of shock be operated upon? Ernst discusses in detail his conceptions of shock and collapse, which he keeps strictly apart. Shock, according to the author, is a reflex following exaggerated stimuli. The centrum sympathicum is under the regulating influence of centers situated in the medulla oblongata close to the nucleus facialis and the cerebrum. In case of shock this central regulatory mechanism is shortcircuited, as it were. The result is hyperexcitation of the peripheral sphere, accompanied by cramp of the peripheral vessels, pallor, drop in temperature, increasing blood pressure, and slow pulse. By way of the spinal cord a part of the stimuli reach from the centrum spinale to the centrum bulbare, continue from here to the nucleus vagus, and cause disturbances of the heart and respiratory mechanism. This is followed by the paralytic stage, with lowered vasomotor tonus, decreasing blood pressure, and accelerated pulse. The traumatic shock turns into collapse. Ernst claims that one should not operate, even in case of lifesaving indications, if stimulus of the nucleus vagus has caused disturbances of the heart and respiratory action. However, this condition presents itself very rarely in practice, because the injured have either died during transportation or they are already in a state of vasoparesis. At this stage the administration of caffeine, adrenaline, or strychnine, must be accompanied by such emergency operations as hemostasis, or amputation of broken limbs. Regarding the elimination of pain, ether and chloroform are recommended for the first aid stations and field hospitals. The author has used ether without a single unfavorable incident. Lumbar and avertin anesthesia do not come into consideration, neither does evipan anesthesia on account of the uncertain duration of its effect. Local anesthesia, used in cases of mass admittance, takes too much time. The preparation of such large quantities of sterile solutions is also impractical.

In the front-line field hospitals the surgeon must, as a rule, pursue a different course than under ordinary circumstances, for example in amputations and indications for laparotomy. In case of amputation the surgeon's first consideration should not be the prosthesis, but rather the safeguarding of life. Therefore, the author recommends Enderlen's technique, i.e. amputation at the point of fracture with a flap taken from the surrounding soft tissue. Regarding laparotomy, the author's experiences, as well as those of some other surgeons of the present war, are unfavorable. Some abdominal shot wounds heal with conservative treatment, even such wounds which would not allow the risk of surgical intervention on account of a bad general condition. Therefore these workers limited themselves to a thorough drainage of the abdominal cavity by inserting a large Mikulicz drain, and observed that from about one-fifth to one-quarter of the injured did not develop peritonitis.

In injuries from grenade fragments the lacerations sustained were usually so severe that even first-class operations could not have saved the patients. Statistics which claim that surgical intervention is capable of decreasing the mortality from 80 to 90 per cent to between 50 and 60 per cent appear too optimistic. Geishoevel, who worked under the most favorable conditions, considered recoveries to be very rare exceptions. The last word regarding conservative and operative treatment of abdominal shot wounds has not yet been spoken. Kirschner, too, seems to have had unfortunate experiences. The surgeon should begin with great caution and by being very conservative, not only in case of laparotomy but

also in case of other major interventions—for instance on the brain, the lungs, and the kidneys—unless actual hospital conditions and postoperative care are possible.

The author made a study of the mortality rates in the field hospitals and found that they amounted to 25.6 per cent in the World War. During the Polish and French campaigns he observed a mortality of from 11 to 12 per cent in the first forty-eight hours. Forty-two per cent of the deaths were due to shock, collapse, and fat embolism in limb injuries, 20 per cent were due to shot wounds of the skull, 23 per cent to shot wounds of the chest, and 15 per cent to shot wounds of the abdomen. These statistics differ from those given by Franz, because the main portion is apportioned to the limb injuries. The author believes that the favorable results during the World War may be increased—only 6.5 per cent of the injured died and 77.9 per cent returned to service—after the introduction of improved transportation methods and the transfer of certain groups of injured patients requiring surgical treatment to well equipped base hospitals behind the lines.

(Franz). Hilda H. Wheeler.

Tobin, W. J., Cohen, L. J., and Vandover, J. T.: Parachute Injuries. *J. Am. M. Ass.*, 1941, 117: 1318.

The authors present a preliminary survey of the injuries sustained during the first year of parachute jumping. (The statistics were obtained from the personnel department of the 501st and 502nd Parachute Battalions and the Group Parachute School.) From August 1, 1940, to August 1, 1941, there have been 4,490 parachute jumps and a total of 121 injuries (2.4 per cent). Of these, 32 were severe enough to require hospitalization. One parachutist was killed. Twenty-five of the patients hospitalized had sustained fractures but no compound injuries occurred. Malleolar injuries totaled 40 per cent of the fracture cases.

All of the injuries except 2 occurred during the last phase of the jump, when contact was made with the ground. The main factors involved in the production of these injuries were cross-wind currents, uncontrolled oscillations, and irregularities of terrain, the wind being the main hazard to the jumping man.

The treatment of all fractures in this group consisted of closed reduction and adequate immobilization. One patient required open operation.

The number of injuries is greatly diminishing, mainly because of the improved methods of preliminary training. J. M. Mora, M.D.

Stocken, L. A., and Thompson, R. H. S.: A Procedure for the Treatment of Gas Casualties. *Brit. M. J.*, 1941, 2: 448.

The cleansing of gas casualties presents two major problems: (1) the treatment of the gas burns on the body surface; (2) the marking, cleansing, and returning to the rightful owners of all gas-contaminated clothing. To obtain the most satisfactory results speed is essential, and an attempt must be made to secure a system of marking clothes for subsequent identification without unduly delaying the starting of treatment.

The cleansing center is divided into male and female sides, each side consisting of a stripping shed, an undressing room, a shower room, and a dressing room, with a common equipment store. The minimum number of workers in each room on each side is two. In the shower room one worker is responsible for douching the eyes of all casualties, while the other has charge of the showers. The medical officer limits his activities to the shower and dressing rooms. In each dressing room, one worker is responsible for all clerical work, and the other supervises the dressing of casualties and carries out first aid treatment. In addition, one or two workers take charge of the equipment store and issue towels and clothing. The duties of the personnel of a cleansing center may be divided as follows: (a) duties on arrival at the center, involving the setting-up of the center so that treatment may start immediately as the casualties arrive; (b) duties during the cleansing procedure.

On arrival at the center the first two workers (male and female) put on full protective clothing (suits, wellingtons, protective gloves, gas masks, helmets, and hoods) and work in the stripping shed. The next two to arrive on each side work in the undressing room, put on suits, wellingtons, gas masks and medium-thick rubber gloves and take further precautions to decontaminate the surface of these gloves as described later. Shower-room attendants, having put on wellingtons and rubber aprons, adjust the water-mixing valves and test the temperature of the water issuing from the showers. They then fill the douche cans with 1 to 2 per cent sodium-bicarbonate solution and hang them on hooks ready for use. Dressing-room attendants first collect and arrange the equipment in the stripping shed and undressing room.

The sequence of cleansing takes place in four stages in the stripping shed, undressing room, shower room, and dressing room.

The equipment of the stripping shed consists of a container of dry bleach, a tray containing 1 in. of a thick suspension of bleach in water and a brush, a bucket of bleach solution, a bucket of water, a jar of anti-gas ointment No. 2, and a pile of "bag units." The latter consist of (1) Bag A, a large numbered sack (21 inches wide and 30 inches deep); (2) Bag B, a slightly smaller sack to which is loosely fastened a numbered tally attached to a string loop for passing over the head. On arrival of a casualty he is told to stand in the tray of bleach solution, to remove the contents of the pockets and his outer clothing and to place them in Bag B. The worker meanwhile brushes the boots with the bleach solution. All outer clothing is placed in Bag A. The boots are then placed in a bucket of water to remove excess bleach and are then put in Bag A, which is then ready for

removal to a laundry. If splashes of gas are observed on exposed skin or hair they are treated with anti-gas ointment; if obvious erythema of the skin has already developed no ointment is applied. The patient then passes into the undressing room with Bag B. The floor of the shed should be swilled down with bleach solution at intervals.

On arrival in the undressing room, each patient undresses completely as rapidly as possible and his clothing is placed in Bag B. Any heavily contaminated clothing that has escaped removal outside is placed in a bin and ultimately destroyed, or if not destroyed it is attached to Bag B. The clothing can then be decontaminated and returned to the owner. Patients are instructed to remove their gas masks last, unless they are liquid-contaminated. Any liquid splashes on the skin or the hair are treated with anti-gas ointment if this has not already been done. When the patient is completely undressed the numbered tally is detached from the bag and hung around his neck, and he then passes to the shower room carrying his bag. Workers should dip their gloved hands into a bowl of bleach solution, and follow by rinsing them in water at five minute intervals; if the gloves become liquid contaminated they should be changed at once for a fresh pair, after the hands are washed in bleach; the contaminated gloves are placed in a bin and decontaminated later by boiling for two hours. The floor of the undressing room is swilled down with bleach solution at frequent intervals.

When the patient enters the shower room, both of his eyes are well irrigated with 1 to 2 per cent sodium-bicarbonate solution. He then steps under a shower, and when thoroughly wet he soaps his entire body and then takes a final rinse. Particular attention must be paid to wetting and soaping the hair. The patient then passes to the dressing room with his bag.

In the dressing room, the patient is handed a towel and a set of clothing. His name and address, particulars of any injury, and number on the bag are noted. The neck tally is given up, and he is given a form of instructions for the decontamination of the contents of Bag B. The instructions contain a warning that the contents of the bag are dangerous. They must not be taken indoors, and cannot be used with safety until they have been decontaminated. All pockets are emptied and spread, together with loose valuables, on the ground in such a way that they are not likely to be blown away or spoiled by rain. They should be left there for not less than forty-eight hours. Keys and other metal objects should be decontaminated directly by boiling for one hour. All clothes and the empty bag should be hung out of doors for at least forty-eight hours; all articles that will stand it should be boiled for two hours. Immediately after handling these articles the hands must be well washed with soap and water. The patient is then supplied with a fresh gas mask and allowed to leave the building.

LOUIS NEUWELT, M.D.

Buxton, P. A.: The Parasitology of Scabies. *Brit. M. J.*, 1941, 2: 397.

The appearance and life history of sarcoptes scabiei, (var. hominis) and its relation to man are described. Methods of treating the patient and killing the organism are not discussed. This parasite is specific for man and, away from him, lives for only a short time. Eight days may be sufficient for the mite to go through the life cycle from egg to adult. It seems probable that one type of burrow with a vesicle in the floor is made by the larva, while the usual larger type in which adults and eggs are found is produced by the nymphs. The itching is caused by the activity of the mite in extending its burrow. Diagnosis is best made by finding the burrow or mite. Scabies is usually derived from another human being but is occasionally due to infestation by sarcoptes of animals such as the horse and camel. Crusted scabies may be due to prolonged neglect but seems due occasionally, to parasites from a host other than man. WALTER H. NADLER, M.D.

Carter, D. L.: The Treatment of Scabies; Use of Sulfur Lather Tablets. *Brit. M. J.*, 1941, 2: 401.

The increased incidence of scabies already present before the war presents a war-time problem. This is apparently due to ineffective supervision of contacts and to the fact that half of the sufferers fail to seek treatment. Ideal treatment must be short and effective in reducing the period of infectivity, must include all contacts and clothing, and must not be too disagreeable to the patient.

A new method of using sulfur, based on Nolan's report in 1937 of the effectiveness of applications of lather of a bland soap containing 18 per cent of sulfur, was used on 29 unselected cases of scabies at a school clinic. Instead of a soap, a tablet that contained 0.72 gm. of sulfur incorporated with a lathering agent was used after a hot bath and, in some cases, scrubbing. After about five minutes, which was required for the lather to dry, a clean vest was put on. The procedure was repeated on two successive days and the patients were instructed in regard to boiling clothing and sheets.

If applied only to school children this plan would be effective in reducing materially the incidence of scabies. WALTER H. NADLER, M.D.

Mackenzie, I. F.: Scabies Treated by a Benzyl-Benzoate Emulsion. *Brit. M. J.*, 1941, 2: 403.

The results obtained in 100 children treated with a benzyl-benzoate emulsion (proscabin, Bayer) as compared with those in 100 cases treated by the sulphur-inunction method are reported. Because of the ease and speed with which the applications can be made, the absence of unpleasant effects apart from a temporary prickly sensation during the painting process, the rapidity of cure, and the almost immediate relief from itching, the author concludes that the benzyl-benzoate treatment is an important advance, satisfactory both from clinical and public health aspects.

Each patient received a hot bath and the body was well lathered with soap and scrubbed. The skin was dried and proscabin was brushed onto the whole body surface from the neck to the toes. The bath and painting were repeated the next day and clean underwear was used; the parents were advised to change and disinfect the bed clothes. Two days later the child was examined and a final precautionary inspection was made after a week.

In 67 per cent of the cases treated with proscabin, only one course of treatment was necessary; 29 per cent required two courses, and 4 per cent three courses. With the use of sulphur inunctions, on the other hand, only 39 per cent of the patients (as compared with 67 per cent in the other series) were reported fit to attend school after one week of treatment.

WALTER H. NADLER, M.D.

Mellanby, K.: The Transmission of Scabies. *Brit. M. J.*, 1941, 2: 405.

In 63 experiments, with underclothing and blankets, scabies was transmitted in only 2 instances, even though everything was done to favor transmission. In 25 experiments, with blankets alone, no transmission occurred. Evidently blankets can seldom, under normal conditions, be responsible for the transmission of the disease. On the other hand, a few experiments have shown that only comparatively slight personal contact is necessary in order to transmit scabies. The itch mite lives beneath the skin of the host during most of its life in contrast to the body louse which lives on his clothes and only attacks the body to feed.

The evidence presented is admittedly insufficient to enable one to dispense with disinfection of the clothing and blankets as a means of preventing the transmission of scabies but this conclusion seems quite probable. The author believes, accordingly, that scabies is normally transmitted by personal contact, either of a slight or of a venereal nature. Children readily infect each other and probably infect their mothers who pass on the scabies to the father. While a large number of cases in the Army are infected on leave, other cases are due to illicit intercourse. There is very little evidence to suggest that in England scabies is being commonly spread from man to man in the Army.

WALTER H. NADLER, M.D.

Muench: Experiences in the Treatment of War Wounds of the Jaw Bone and the Face (Erfahrungen ueber die Behandlung von Kriegsverletzungen der Kiefer und des Gesichtes). *Deutsche zahnaerztl. Wchnschr.*, 1941, p. 79.

On the basis of previous experience two principles can be laid down:

1. On the whole, neither in the manner of treatment nor in the eventual complications can wartime fractures of the jaw be compared to those of peacetime fractures.

2. The experienced peacetime surgeon will be placed in an entirely new situation in war which requires a background of medical and surgical knowledge as well as orthopedic skill.

Contrary to the experience of 1914 to 1918, a practical fulfillment of one fundamental demand is possible, namely, that with few exceptions difficult jaw wounds are very soon made the object of hospital and medical care by means of transport and sanitary planes. The author emphasizes, as many another with practical experience in this work, that no stereotyped procedure can be followed, but that individual cases must be handled differently. However, one thing can be said at the present time and that is that in most cases today primary suture is not made. Lacerations in the region of the lips and of the red portions of the lip are sutured primarily, however. In the course of conservative treatment of open wounds of the soft parts, the approximation of the wound edges and the tight-fitting dressing of Klapp is most approved. The cod-liver-oil-ointment treatment has given extraordinarily good results.

One cannot be too conservative in leaving the bone fragments alone. The author agrees with Pichler and Reichenbach among others in that before operative interference is attempted the jaw should be splinted; this is in contrast to Axhausen's belief. The Angle bandage V 2 A, spiral wound bands, and elastic immobilization with rubber bands are employed almost without exception.

The author presents a selection of interesting cases with pictures.

(GERLACH). MARIAN BARNES, M.D.

Garcin, R., and Guillaume, J.: The Treatment of Brain Injuries in a Neurosurgical Group at the Front (Note sur le traitement des traumatismes craniens observés dans une formation neurochirurgicale de l'avant). *Mém. Acad. de chir.*, Par., 1940, 66: 557.

The authors have studied 98 cases of brain injuries of different type. The lesions included extradural, subdural, and subarachnoidal hematomas, foci of cerebral necrosis, generalized or localized cerebral edemas, infected wounds, and complications of different kinds.

According to the authors, in all severe cases of brain injuries which have been followed from the beginning, a surgical intervention is indicated if there is no improvement within the first ten hours. The conditions of the patients must be studied from the point of view of the consciousness of the patients and of the sympathetic and neurological symptoms. The site for trepanation will be chosen according to the topography of the lines of fracture and the neurological symptoms of localization. It will then be possible to study the meningeal and cerebral lesions such as localized edema and serous meningitis. Sometimes the openings must be enlarged to evacuate a hematoma, to reach a bleeding vessel, or to insure decompression. When the brain dilates and starts again to pulsate it is rare that a lesion is found on the opposite side; however, when the cere-

bral tension does not improve rapidly after a decompressive operation and the bitemporal operation is not satisfactory, a ventriculography is indicated. The ventriculography will reveal either a dilatation or a reduction in the size of the ventricles. Ody's operation is indicated in the first case, while in the second an extensive decompressive operation is preferred.

In the presence of a comminuted fracture with destruction of brain tissue particular care should be given to the reconstruction of the osseous vault, closure of the meningeal sac, and hemostasis. All of the patients with brain injuries must be watched carefully even if their general condition is apparently very good. In the presence of post-traumatic symptoms such as cephalea, dizziness, vomiting, and bradypsychia, an encephalogram is always advisable both for diagnostic and therapeutic purposes. Encephalography which reveals and leads to treatment of the minimal pathological changes will probably prevent late epilepsy or the chronic formation of hematomas.

The systematic use of sulfonamides has reduced the infectious complications to almost nothing and is always indicated. C. L. PIRANI, M.D.

Sutherland, J. D.: A Survey of 100 Cases of War Neuroses. *Brit. M. J.*, 1941, 2: 365.

"Observations on 100 men suffering from psychoneurosis following combatant service showed that 80 of them had had previous traits indicating emotional instability. The illness of 36 men was merely an aggravation of previous psychoneurosis, and in 33 it was associated with a definite predisposition to breakdown. Temperamental instability, revealed by frequent changes of job, was present in 11. Of the 20 men with no previous history one-half were much older than the rest of the group, and the disturbances in the younger half were mild.

"Some observations are made on the possible selection of these cases and on their treatment and psychopathology.

"When the liability to further breakdown was taken fully into account the recommendations for future disposal led to 72 of the group being discharged, 9 returned to full duty and 19 returned to a lower grade of service."

Stich, R.: The Treatment of Gunshot Fractures of the Extremities (Ueber die Behandlung der Schussbrueche der Gliedmassen). *Med. Welt*, 1941, p. 29.

This article is well worth reading even if it brings nothing new to the experienced surgeon. Attention is called to certain things. Von Bergmann, in the Russian-Turkish War, cured 15 gunshot wounds of the knee, 14 by aseptic bandaging and the application of plaster casts alone; while of 57 patients who were not placed in casts 24 died, 5 were discharged with doubtful results, and only 28 were cured. In the American War of Independence 837 of 1,000 soldiers with gunshot wounds of the kneejoint died.

The belief of von Bergmann that on the field there must be no choice and individuality must yield to rule was not borne out in the World War. Garré found the same opposition to his proposal of widely opening severe grenade wounds and keeping them open. Stich first treats shock with the usual means and injects ½ per cent novocaine solution through a sound portion of the skin into the bone wounds. Boehler has quite correctly said, that local anesthesia will often be sufficient by itself to overcome immediately the condition of shock.

In patients with severe hemorrhage blood transfusion or the intravenous infusion of from 100 to 300 cc. of dextrose solution is indicated. The question of amputation in its relationship to later employment or the probability of severe wound infection can be decided only by surgeons with large experience. However, if amputation is indicated then it should be performed immediately after shock has been combated. To prevent gas edema Stich gives all wounded patients with grossly contaminated wounds from 40 to 60 cc. of serum in the muscles near the site of the wound. He omits the administration of internal antiseptics since he considers it unfavorable under some circumstances. Experiences with the prontalbin-mesudin mixture of Domagk is lacking. Gunshot wounds with small E. and A. (simple gunshot wounds, small grenade splinters) should be aseptically bandaged and placed in plaster. Only in joint wounds of large caliber without severe bone comminution does Stich débride the external wound and close it with several widely spaced sutures of the skin and sometimes of the capsule. The Friedrich wound débridement with subsequent suture is not considered for many reasons. In the majority of fractures due to gunshot, only physical disinfection with the knife comes into question within twelve hours since they usually are associated with large wounds of the soft parts. The suture of such wounds is forbidden. If the twelve-hour limit is exceeded then only the Garré wound toilet is indicated. Exploration with the gloved finger, represented as unorthodox, is therefore not always circumvented. In this situation the wound must be broadly layed open and drained. Stich states that according to his experience it is not generally recognized that such wounds can be made smaller after some days by careful suturing if the fever is absent, the pain is disappearing, and the pa-

TABLE I.—RESULTS SHOWING THE IMPROVEMENT IN THE TREATMENT OF OPEN GUNSHOT FRACTURES

Author	Year	Number of cases	Deaths %	Amputations %	Surviving and not amputated %
Billroth	1860–1867	219	68.8	20.0	27.0
Zuerich Clinic	1899–1929	675	14.9	18.5	66.5
Boehler-Ehalt	to 1937	307	3.5	4.58	91.8

tient has recovered to some extent. After careful wound handling he does not apply cod-liver-oil dressings to fresh war wounds. He believes immobilization is in order in every case of gunshot fracture and applies a plaster cast for this purpose. In conclusion he shows the improvement in the results of the treatment of compound fractures.

(Franz). John R. Paine, M.D.

Stracker, O.: Shotgun Wounds in the Fifth Month After the Campaign in Poland (Schussverletzungen im fuenften Monat nach dem polnischen Feldzug). *Ztschr. f. Orthop.*, 1941, 71: 335.

The experiences here reported were gained by the author in the military hospital at Cracow, chiefly on wounded Polish soldiers. They had been treated at first by Polish physicians, and it was only since January, 1940, that they were taken over by the German Medical Service. Ninety per cent of the material which the author received consisted of gunshot wounds of bone (amputations included). Those who had received lighter wounds had, for the most part, already been discharged. Results had not been good. The author blames this on the faulty early treatment, that is, with regard to primary immobilization: splints of wood, wire mesh, or sheet metal are not satisfactory. The best splint is still the plaster-of-Paris splint without padding, not the plaster-of-Paris dressing, and this not only for purposes of transportation but also in the stationary treatment as long as the wound suppurates. The celloma bandages were excellent: they needed little water and hardened very quickly.

The author then turned his attention to the effects of the injuries on the bone. He was struck by the extent of the comminutive injuries of the bones, often as much as 15 cm. The comminutive fractures were not dependent upon the character of the missile (rifle bullets or shell fragments). (The author is perhaps inexact in stating that in the World War the bullets were snub-nosed; even at that time, with very few exceptions, all the nations at war were using sharp-nosed bullets.) The present day greater initial velocity has had less the effect of producing large fragments than of comminuted areas. His statement that the great majority of shotgun fractures had resulted in osteomyelitis is striking, with high fever for weeks and subfebrile temperatures for months. The fractures of bone which had been under treatment resulted, for the most part, in unsatisfactory positions; this could certainly have been avoided. However, since the callus remained soft for a long time as a result of the infection, even as late as eight months afterward, improvement could be attained by means of extension treatment. The author also recommends that shotgun wounds of the bones and joints be not moved from hospital to hospital, but be brought to a special hospital when possible.

The author then appends individual case histories with illustrations:

The thigh. Of the 10 juxta-articular fractures in the neighborhood of the neck, 8 exhibited a very severe coxa vara and contracture of the adductors. All were still discharging pus from fistulas. The shortening was between 4 and 6 cm., in 2 instances 10 cm., and in 2 other cases 12 cm. The shotgun wounds of the diaphysis (25 cases) almost all had a fever up to 40.5 degrees for several weeks, this was followed by sub-febrile temperatures for months. Almost all the wounds stank; this was probably due to the unsterilized or faultily sterilized dressing materials. The patients which were treated with plaster-of-Paris dressings or extension did not suppurate so intensely or so long. The shortening was from 4 to 11 cm. Angulations in the sense of varus and of recurvations were frequent. The fistulas were widened by means of laminaria tents. The Steinmann nail was frequently used by the author. Operations for the removal of sequestra should be done only late; however, an attempt should be made to remove splinters by extraction through the dilated fistula. The neighboring joints were almost always stiffened.

The lower leg. In most cases the care of the wound began at once, only in a few, after six hours up to three days. In spite of this, primary healing did not occur in a single case. Of the 33 cases only 4 were healed after five months; the others had all developed phlegmons and were still discharging pus copiously. Here again there was osteomyelitis. The defects were frequently from 4 to 6 cm. in extent. Conditions were more favorable when the fibula was intact. Otherwise, there were shortenings of from 1½ to 5. cm.

The foot (20 cases). Here again, particularly in wounds of the tarsal region, there was slowly progressing osteomyelitis with high fever. Very frequently there resulted not only a pes equinus, but other deformities as well. Consequently, the author recommends early amputation, since the patient, even after recovery, will walk with difficulty. Otherwise he recommends a dorsal plaster-of-Paris splint from the toes to the knees, and treatment of the fistulas with Chlumsky solution.

The upper arm (31 cases). As a rule the wire mesh splint gradually sank downward, since the band about the neck had been omitted. In this wise there was frequently a valgus angulation in the fractures of the upper third. There was an auto-angulation which was encountered in fractures of the diaphysis and the lower third. This was due in most cases to the fact that the abduction splint had been directed too far backward; since the normal position of the arm in the shoulder joint is directed about 30 degrees anterior to the transverse plane of the chest, with the faulty application of the abduction splint the pectoralis muscle and a portion of the deltoideus are put under tension and drag the proximal fragment of the humerus anteriorly. The shoulder and the elbow joints were very frequently stiffened. Suppuration was very intense, and even after five months fistulas were still present. The fever did not last as long as in the fractures of the thigh, for the most part only two or three weeks. An approximate sixth of the cases developed pseudarthroses, responsibility for which was

assumed to be the extensive zones of comminution. Supracondylar fractures can be corrected only with elimination of the drag of the pronators. They must, therefore, be put up in full pronation of the forearm. Paralyses were present in 9 cases; of these 6 were of the radialis.

The forearm. There were only a few cases, all of which were suppurating. Paralyses were present in 3 instances, of which 2 were total paralyses of the medianus nerve.

Hand and finger. All of these wounds exhibited marked edema and contractures.

Of the 18 amputations of the thigh, two-thirds had to be reamputated, since the bone was exposed or was covered by a thin, unsatisfactory cicatrix. Contractures of the stump were easily corrected. In the amputation of the forearm the stumps had been made too long for application of the prosthesis.

(Franz). John W. Brennan, M.D.

Lenormant, C.: The Use of the Sulfamides in the Treatment of Wounds (Sur l'emploi des corps sulfamidés dans le traitement des lésions traumatiques). *Mém. acad. de chir.*, Par., 1940, 66: 883.

The use of the sulfamides in the treatment of war wounds was begun in the third army in September, 1939. Reports of various surgeons are given in this article and the results are most encouraging.

The drugs are dusted over the wounds in the form of powder, inserted into them in the form of pencils, or used in the form of liquids to irrigate them. They also seem to be effective in the prevention of infection when given by mouth. The most effective of these drugs in the prevention and cure of infection seems to be 1162 F. The drugs are not bactericidal but bacteriostatic, that is, they prevent the growth and reproduction of the bacteria. They seem to be effective not only in prevention but in the control of infection even after it has begun.

The use of these drugs does not take the place of surgical treatment. Wounds should be treated surgically just as they have in the past, but the addition of the sulfamide treatment prevents the development of many infections that would otherwise occur. Reports from a number of military surgeons are given and they are all favorable to the use of these drugs except that of Sarroste and Fauvert. These surgeons report that they have seen little effect from the use of sulfamides, but they treated only a very few cases and probably used too small doses of 1162 F.

It cannot as yet be said that these drugs have brought about a revolution in the treatment of wounds, but the results are so encouraging that their use in the case of war wounds should never be neglected. Audrey G. Morgan, M.D.

Beyer, W.: Serum Treatment of Gas Infection (Zur Serumbehandlung der Gasoedeme). *Muenchen. med. Wchnschr.*, 1941, 1: 61.

Opinions concerning the curative effect of serums are still very divided. Concerning one thing, however, one can be certain: if serum is to give results it must be employed in large doses. Domagk has tested the problem in animals but a large experience in man is lacking.

Beyer reports on 3 patients who developed gas infection proved by bacteriological means. In 2 cases the infection was due to Fraenkel's bacillus and in the third case to Fraenkel-Novy's bacillus and the bacillus putrificus. In 2 cases jaundice appeared in addition to the local phenomena and the severe general reaction. Serum was given in a proportion of 1:5 with physiological salt solution, on the first day 500 cc. by the continuous intravenous drip method and then later 100 cc. daily by the intravenous method. In 1 case a total of 800 cc. was given, in the others 1,500 cc. and 1,650 cc. respectively. In every one of these cases healing occurred; of course, surgical treatment was also instituted. The rapid subjective and objective improvement in each case was astonishing. By relying on serum it was possible to prevent disarticulation of the arm in 1 case and disarticulation of the leg in 1 of the others. The author could not convince himself, however, concerning the effectiveness of the prophylactic dose for he had given 100 cc. of serum intravenously in 1 case on the day of the accident and nevertheless on the third day a most severe gas infection developed.

The detailed clinical histories show that Case 1 was a wound from a bomb splinter with a fragment in the shoulder; Case 2 an automobile accident with supracondylar compound fracture of the upper arm; and Case 3 an amputation due to arteriosclerotic gangrene of the lower leg. In the 2 first cases the wounds were sutured with drainage after surgical treatment. The author does not say whether the amputation stump was sutured also.

(Franz). John R. Paine, M.D.

Hinman, F.: Care of the Bladder at the Front When Paralyzed by Injuries to the Spinal Cord. *J. Urol.*, 1941, 46: 499.

Vesical overdistention from paralysis of the bladder leads to urinary sepsis, and the abused skin from soaking of the bed to decubital ulcers. Their prevention is the objective in the care of the paralytic bladder. Some people find it difficult to urinate lying down. Some even cannot urinate in public. Spinal-cord shock produces retention, but another kind of shock might also cause it. Furthermore, obstructive conditions such as median bars, urethral strictures, and vesical stones can produce acute retention. The treatment of these psychical and obstructive types of retention present an entirely different problem from the management of the bladder paralyzed by a spinal-cord injury. Not all paraplegics have paralyzed bladders. These distinctions are essential to proper management.

The initial effect of a spinal-cord injury on micturition is the same regardless of the level of the cord injury. The retention and overflow incontinence may last only a few days or may persist for many

months; this depends on the location and the severity of the injury. The type of recovery from this initial effect likewise varies with the place and extent of the lesion. There are two effects of spinal-cord injury: (1) the initial effect of retention and overflow incontinence; and (2) the variability in the time and type of recovery, which demands two periods of management of these patients. There is only one period of management in temporary acute retentions. There are two periods of management in the permanent neurogenic bladders, the first dealing with the initial retention and overflow incontinence common to all, and the second with the changing types of dysfunction, which depend on which of the three levels of innervation is injured and the extent of the injury. This difference must be thoroughly understood because the methods which may be used in the temporary group are dangerous when employed in the permanent group. So great is this danger that the least doubt in the proper grouping of a patient with acute retention should place him automatically in the second group, the management of which will cause no damage should he be found later to properly belong to the first. There should be no temporizing in coming to a decision. The examination must show definitely that the retention is neurogenic. Otherwise, intermittent catheterization is the only thing not to do, and yet it is the very thing most frequently done. If repeated over a few days of indecision, vesical infection, reflux to the kidney, and pyelonephritis result. Only with temporary retention can intermittent catheterization be used safely. With doubtful and suspicious permanent dysfunction, it should never be used.

The method of non-interference, allowing distention and overflow, is occasionally justified by circumstances, but should be attempted only as a temporary expedient when opportunity and facilities for proper care are wanting. Rarely does an uninfected bladder thus neglected ever rupture. Rarely in the paralytic is distention and overflow incontinence painful. Prolongation, however, may embarrass respiration and cardiac action, induce shock, and cause vesical hematuria. When urinary infection is present, prolongation of distention is extremely dangerous because of the imminence of rupture and ascending infection, and the abused bladder may never regain its tone; thus, the hope of acquiring later automatic micturition is destroyed.

Non-catheterization and manual expression of the urine is the best method for the early development of an automatic bladder and may save months of catheter treatment. It is also the best method of avoiding urinary infection. It must be applied regularly to be successful. It is indicated only in the absence of urinary infection and mechanical obstruction. The bladder should be emptied as completely as possible every four hours (at 2, 6, and 10 a.m., and 2, 6, and 10 p.m.). At these times the patient should be instructed to exert as much intra-abdominal pressure as possible, while the surgeon massages the bladder from above downward toward the symphysis with the palms or ulnar surfaces of his hands. The bladder should never be squeezed. Turning the patient on his side may facilitate the process. Later, the stage of reflex activity being reached, stroking of the soles of the feet and the skin of the thighs or abdomen may provide additional aid. As the bladder gradually develops more emptying power there is less need for manual expression. The advent of infection is the one real contraindication for this method.

The retention catheter with continuous tidal irrigation has advantages over a simple retention catheter or intermittent catheterization which may seem slight, but experience has proved that the prevention of overdistention of the bladder by continuous drainage and the reduction of infection by the automatic irrigation are advantages missed by both other methods. Furthermore, the retention catheter with tidal irrigation hastens the development of an automatic bladder. During entrainment or other emergencies, regular intermittent irrigations can be substituted temporarily for continuous tidal irrigation. A simple retention catheter should be irrigated twice daily and should never be plugged between irrigations. Tidal irrigations require constant supervision and the catheters must be changed at regular three to seven day intervals. If these retention catheters are neglected, pronounced periurethral infections occur, and result in large sloughs of the bulbous and perineal portions of the urethra with impossible healing. Neglect of these catheters also leads to vesical stones and encrustations. This method of treatment prevents overdistention, reduces infection, and keeps the patient dry, thus preventing bedsores. It does not hinder the development of an automatic bladder. The disadvantages are invariable infection and the necessity of faithful, trained, and efficient care and management.

The routine use of suprapubic cystotomy and continuous drainage seems radical at the onset of acute retentions. It is often indicated later when manual expression fails; when a urethral catheter is not tolerated; when a virulent urethritis, an acute prostatitis and epididymitis, or an ascending infection develops; or when uncontrollable vesical hemorrhage occurs. A safe rule is to insert a suprapubic tube immediately when the injury is severe, regardless of its location, provided it will be days or weeks before the patient can be given faithful and technical management. In deciding in favor of a suprapubic cystotomy at the front, foreknowledge of the location and extent of the lesion is not particularly helpful. An automatic bladder is almost always acquired after lesions above the lumbar center, and often with complete division of the cord, active incontinence may occur as early as twenty-five days after the injury. In less severe damage and partial divisions the bladder may begin to act automatically much earlier and may even regain normal function. Automatic micturition also follows lesions of the cord lower down but after longer intervals from the time of injury. The thing of utmost importance is

that renal infection be prevented during the transition period, no matter how short it is, and no matter where the lesion is or what the subsequent dysfunctions are. Urinary drainage is the one way of prevention and aseptic urinary drainage is the best. Regular periodic manual expression, retention catheter, and suprapubic cystotomy are the only means of securing continuous drainage with the least risk of pyelonephritis. The delay of even a few days to reach a base hospital is too much. A simple suprapubic kit should be a part of the emergency outfit and suprapubic cystotomy should be done for the acute retention of spinal-cord injury at the earliest opportunity. The urethral catheter should be used only for psychical or obstructive retentions.

In an emergency suprapubic cystotomy, the skin should be shaved and cleansed, and a large trocar should be plunged through an inch-long incision just above the pubis into the distended bladder. The obturator is withdrawn, a bulb or Foley catheter on a straight stylet is passed through the trocar which is then withdrawn, and the catheter is left in place. The catheter is pulled back until its bulb impinges on the bladder side and one skin stitch of the incision ties it in. The end is left open to drain continuously. Vesical distention must never be allowed.

These are the alternatives: (1) the patient may be left to be cared for at the next emergency station; (2) manual expression, applied regularly, may be tried; (3) a catheter may be fastened in the urethra to drain continuously and tidal irrigations are started at the first opportunity; or (4) suprapubic cystotomy may be done. The methods of non-catheterization and manual expression, or use of the retention catheter and tidal irrigations may be inapplicable at the front or at the various evacuation stations to the base hospital. It is permissible to allow distention and overflow for hours but not for days. Therefore, suprapubic cystotomy may be clearly indicated at the onset of the acute retention.

LOUIS NEUWELT, M.D.

Houlding, R. N.: Rehabilitation of Injured Air Crews. *Brit. M. J.*, 1941, 2: 429.

If function is to be restored as soon as possible, muscular wasting and joint stiffness must be prevented. Muscle power and tone can be regained only by voluntary contraction and relaxation. Progressive remedial exercises form a basis of treatment, but the willingness of the patient to contract and relax the affected muscles at all hours of the day, wherever he may be, is the key to success.

Having received the necessary surgical treatment in an orthopedic hospital, casualties are transferred to a rehabilitation center as soon as they have recovered sufficiently to become ambulant. The keynote of treatment is activity, in the form of progressive remedial exercises and games. The onus of recovering the function of an injured part is thrown on to the patient. The nature of his lesion is explained to him simply, and he is told what to do to overcome it. Passive treatment (massage and electricity) is avoided unless definitely indicated. By recording daily the range of movement of a stiffened joint with a goniometer, or the strength of a wasted muscle group against the resistance of weights running over pulleys, the patient becomes interested in overcoming his disability and enthusiastic over his progress. Having gained his cooperation, it remains only to supervise his progress and to ensure that his activities are graduated.

The rehabilitation department is in charge of a medical officer, assisted by a physical training officer, a sergeant, and three masseuses. The department is run in close collaboration with the sports officer, who organizes all kinds of competitive games for those in walking plasters and those who are nearly fit. Every orthopedic patient performs at least two sessions of special remedial exercises, mostly of a non-weight-bearing character, under individual supervision by a masseuse. When muscular tone is regained he joins the "nearly fit" class, in which he performs general remedial exercises of a muscle-developing nature, and swims, in addition to his special exercises. He is encouraged to perform the latter at every opportunity throughout the day. Finally he graduates to the "fit" class and participates in all organized activities. The general remedial classes are run concurrently for forty-five minutes. These are followed by a ten-minutes' rest interval and then by competitive games such as skittles and volley-ball; both classes then adjourn to the swimming bath. During the afternoon, golf, tennis, swimming, and volley-ball tournaments are arranged by the sports officer, who is advised exactly as to what each patient should and should not do. Dancing is of considerable remedial value. Occupational therapy is not employed to any great extent, since more improvement is made in the early stages of treatment by encouraging the patient to concentrate on overcoming his disability by working away at it all day long. In the later stages the patient's attention is diverted from his injured part by participation in competitive games. No vocational training is given during the patient's stay in the hospital.

A patient left to his own devices after an operation is naturally fearful of exerting too much activity rather than too little, and he should therefore be made to realize that the function of a plaster cast is not to prevent the use of an injured part, but rather to enable him to use it to the greatest extent compatible with immobilization of the fracture. A properly applied and intact cast will immobilize the fracture whatever the patient may do. Supervision is necessary to ensure that the plaster remains intact and comfortable and that the patient does make frequent use of every joint not necessarily immobilized. With supervision, excessive muscular wasting is avoided and, by restricting activity to non-weight-bearing exercises until muscular tone is regained, the period of incapacity is minimal. The patient should be steeled against all phobias. The daily observation of progress engenders optimism, and the progress made by others, in addition to

suggestions by posters and by the staff, ensures co-operation from the patient. Compulsion is seldom necessary and should be avoided because it evokes an attitude of obstinate resistance. Before discharging a patient to flying duties he should have regained his confidence to perform all normal activities.

Physiotherapy is of great value for selected cases. It is given sparingly because some patients prefer to lie at ease on a couch and receive treatment, which is a poor substitute for their own activities. In the rehabilitation department only radiant heat is used to loosen up stiffened joints before remedial exercises are started. Faradization is used only for helping the patient to acquire the knack of contracting greatly wasted muscles and it is discontinued as soon as he has learned to do this himself. Galvanization serves to reassure a patient with a peripheral nerve lesion that the paretic muscles will still contract and also helps to disperse static congestion. Deep massage will loosen muscular adhesions, but is seldom necessary if the patient can contract his muscles throughout the period of immobilization.

For the purpose of rehabilitation, patients with fractures fall into two groups—those in whom the fractures are uniting and require immobilization, and those in whom the fractures have united and who require remedial treatment to restore the tone and strength of their muscles and the movements of their joints. Hastening the union of a fracture is possible with complete immobilization of the fragments and stimulation of the blood supply by muscular contraction. To immobilize the fragments of the shaft of a long bone, the joints at each end of the bone must be fixed in a degree of flexion sufficient to prevent rotation between the fragments. Complete immobilization of a fracture can be ensured only by internal fixation, and a plaster cast alone probably seldom effects complete immobilization because of the interposition of soft tissues between the plaster and the bone. In the treatment of any fracture just as much attention should be paid to the soft tissues as to the fracture.

To adapt a leg plaster for walking purposes the author uses a wooden heel, which is laced on to the plaster by means of a canvas "spat," and a toecap. The heel is hollowed out on its upper surface, to which is glued a layer of ½ in. of sorbo rubber. If the heel of an above-knee plaster is raised with a ¾ in. plaster slab before the walking-heel is applied, and the heel of the shoe on the sound leg is raised with a ¾ in. wooden block, the patient is able to walk without sticks or crutches, with an almost natural gait. This stability encourages him to rock forward on to the toes. This walking plaster enables the patient to actively contract the flexor muscles of his toes while walking without limping; muscular wasting and stiffness are minimal when the plaster is discarded and function is rapidly regained. Several weeks of incapacitation may be prevented by mobilizing the knee-joint two weeks before the plaster is discarded. This is done by reinforcing the anterior part and cutting away the posterior part of the above-knee position of the plaster so that the patient is able to sit and swing his leg, and thereby regain flexion movement. For walking, the plaster is bound to the thigh with a bandage. After the plaster has been discarded full movement of the knee-joint is regained by non-weight-bearing exercises, flexion and extension, (rowing and bicycling) until the strength and tone of the quadriceps muscle are regained. The patient is not discharged until his calf muscles are powerful enough to raise him on to his forefoot without assistance. After the walking plaster is discarded the swelling of the extremity requires the support of an elastic bandage until sufficient tone is regained by the calf muscles to maintain the venous circulation. Congestion is the prelude to adhesions; therefore the tone of the calf muscles must be maintained during immobilization.

Compression fracture of one or more vertebral bodies is a common injury among air crews, and in many cases it is not associated with spinal-cord injury. These fractures can usually be decompressed by the pull of the anterior longitudinal ligament upon hyperextension of the spine by the two-table technique. With this technique comminuted fractures should be maintained for at least five months in a Watson-Jones plaster jacket. Premature mobilization of a fractured vertebral body may be followed by progressive wedging and absorption of bone. Activity is an essential part of the treatment throughout the period of immobilization. Extension exercises are performed daily and a progress chart is kept of the weight which each patient is able to raise over a pulley by extending the spine.

Manipulation of a stiff joint is indicated only when as the result of his own unaided activities the patient is unable to increase the range of movement of the joint and the joint has not been subjected to any form of passive stretching. The manipulation should be done under full surgical anesthesia and not until the adhesions have become crisp and avascular so that they snap easily and are followed by a minimal amount of reaction. It should not be repeated at intervals of less than two months. Active unaided movements are begun as soon as the anesthesia has passed off and should be repeated at hourly intervals. In fracture of the patella the latter should be mobilized before manipulation is attempted. A bony block should be excluded by means of the x-rays before manipulation is begun. Any existing focal infection should also be eradicated before manipulation is started.

In dislocations of the shoulder-joint, the dislocation may recur unless the tone of the surrounding muscles is fully restored. The dislocations of joints are often associated with nerve lesions. A decreased range of movement of a joint from the shortening of muscles or their tendons may arise from prolonged splinting and result in flexion of the fingers when the wrist-joint is extended. The wrist must be stabilized by a plaster splint, and the fingers can then be extended slowly by the pull of elastic stretched between a wire frame and stalls worn on the fingers.

In the after-treatment of burned hands, provided that the tendons and joints are intact, the patient should be assured of a great degree of recovery and urged to work away at his stiff joints all day long. If the fingers are stiff from adhesions, movement is regained by immersing the hand in olive oil or in fuller's earth paste heated to 110° F. for two sessions of fifteen minutes daily. The patient should squeeze a piece of rubber sponge or a ball while his hand is being heated. For the rest of the day he wears a detachable splint which dorsiflexes his wrist, and a glove, to the finger tips of which are attached lengths of elastic that are tied around a hook in the splint.

LOUIS NEUWELT, M.D.

Harris, R. S.: Nutrition in War. *New England J. Med.*, 1941, 225: 575.

The author states that even in this country we have been living on a dietary borderline as far as necessary nutritional factors are concerned, and reviews the reasons for this deficiency. The importance of nutrition of armed forces and of the civilian population in time of war is discussed, and the need of feeding millions of people after hostilities have ceased is stressed. WALTER H. NADLER, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Petermann, F. J.: Late Hemorrhage After Injuries (Spaetblutungen nach Verletzungen). *Ztschr. f. d. aerztl. Fortbild.*, 1940, 37: 694.

Late hemorrhage may begin days or months after an injury. In the World War the frequency of late hemorrhages amounted to 0.5 per cent for all of the wounded; the mortality was 60 per cent.

In septic late bleeding or oozing of blood from infected wound surfaces or cavities the cause was opening of the blood vessels by pus. Treatment consisted of pressure bandage, tamponade, blood-clotting substances (stryphnon, Vitamin C) and especially of strengthening the system and combating infection with Prontosil. Transfusion of from 300 to 500 cc. of blood is always good. For frequent bleeding, irradiation of the spleen should be tried.

Sudden, dangerous, profuse late hemorrhage following wounds of a large or medium size artery, often occurs when a clot formation suddenly gives way; when a bullet or bone splinter which has blocked a vessel is displaced by muscle action or operative removal; when a thrombus is loosened by mechanical action, caused by changing a bandage which might have helped to close off a vessel through muscle and connective tissue; but most often when a thrombus melts away in pus. This is favored by motor unrest of the patient, psychic agitation, and mounting blood pressure. Temporary control of the hemorrhage is necessary immediately, on the extremities by means of a tourniquet, on the neck, chest, or abdomen through digital compression (with rubber gloves) of the bleeding vessel or the place of injury of the vessel in the wound. Bier recommends fastening a tampon in the wound by means of a suture after drawing the wound together firmly with the hand. No time should be lost through an attempt to apply a clamp.

After provisional control of the bleeding, the attempt should be made to tie off the artery proximal and distal to the point of injury. Deep narcosis is necessary. The vessels of the extremities should be freed under an Esmarch bandage, on the neck and trunk under a temporary closing off of the vessel with a restraining suture or a weak clamp. The place of the ligature is important. The collateral circulation contributing to the bleeding also should be ligatured. In ligating larger arteries it should be made certain that important branches are not included in the ligature, e.g., in bleeding from the external carotid the central ligature should not be put on the common carotid. After severe hemorrhage, blood transfusion should be given. Late bleeding is most surely avoided by fundamental wound support. In suspicious wounds, late hemorrhage should be watched for day and night.

(FR. GENEWEIN). MARIAN BARNES, M.D.

Gold, H.: Sensitization Induced by Tetanus Toxoid, Alum Precipitated. *J. Lab. & Clin. Med.*, 1941, 27: 26.

In many individuals the injection of tetanus toxoid (alum-precipitated) is followed by the development of a specific sensitivity to the toxoid and some of its constituent proteins, as demonstrated by positive skin tests. Two types of skin reactions are obtained: (a) an immediate reaction (erythema wheal formation) that develops in fifteen minutes, and (b) a delayed reaction which consists of erythema, induration, papule formation, and local swelling that reaches its height in twenty-four hours and then subsides gradually.

Berna peptone when present in tetanus toxoid (alum-precipitated) appears to sensitize more readily than Difco proteose. Hence it should be eliminated from the medium in which the tetanus bacillus is grown as suggested by Cooke.

Evidence has been presented to indicate that sensitization to the toxoid protein or the bacterial proteins found in the immunizing preparation may also occur following the injection of tetanus toxoid (alum precipitated).

In the author's experience there is no apparent correlation between the high incidence of positive skin tests and the low incidence of clinical manifestations of allergy following the injection of alum-precipitated toxoid. This is corroborated by a review of more than 1,700 patients immunized with two or more doses of alum toxoid, which shows the occurrence of 2 cases of urticaria following the second injection in one case and a number of injections in the other. This lack of correlation is further demonstrated by the occurrence of urticaria in persons with negative skin tests (Cooke's 2 cases) and the absence of any allergic reactions following the injection of alum toxoid in 4 of the author's patients who had marked positive reactions.

Little practical value can be expected from routine skin testing before the injection of tetanus toxoid. This would serve only to render cumbersome an otherwise simple and effective method of immunization against tetanus. As in any other immunizing procedure, the occasional occurrence of an allergic reaction should be kept in mind and epinephrine hydrochoride (1:1000) should always be available.

SAMUEL H. KLEIN, M.D.

Ramon, G.: Solution of Tetanus Antitoxin and Prophylaxis of Accidents Due to Serum for the Prevention of Tetanus (Solution d'antitoxine tétanique et prophylaxie des accidents sériques dans la prévention du tétanos). *Mém. Acad. de chir.*, Par., 1940, 66: 569.

Vaccination with tetanus anatoxin affords efficacious and prolonged protection against tetanus, but until individuals and especially large bodies of men, like the armies, have been vaccinated, antitetanic serum therapy has to be used for the prevention of the disease in the wounded and not yet immunized subjects. The drawbacks of this method are that the protection is only temporary and that the serum may cause early or late accidents, the latter being known under the name of serum disease. These accidents are observed in 40 per cent of the adults submitted to the treatment, and some nervous complications, such as amyotrophic paralysis of the upper extremities or radial paralysis may produce permanent disability; fatal results have even been reported, but these are, fortunately, rare. Lately, Ramon has discovered the means to reduce greatly, if not to eliminate, the percentage and the gravity of the serum accidents.

From the first attempts at immunization with the tetanic anatoxin, it has been noted that this antigen is capable of creating in the horse and in man a special aptitude to react by the production of a considerable increase in antitoxin when a second dose of the same antigen is injected. In addition, the influence of certain substances which stimulate immunity, particularly tapioca, has contributed to a series of advances in the methods of producing antitetanic serum, which at present is 30 to 40 times more potent than the old serum and reaches a titer of from 4,000 to 12,000 antitoxic units per cubic centimeter. With these potent serums, the antitoxic power of which may be further increased by artificial concentration, Ramon has prepared a solution of tetanus antitoxin which contains from 10 to 20 times less protein than the usual horse serum; besides, the reduced proportion of protein can be denatured by adding to the solution of antitoxin a small amount of formaldehyde (1 cc. for 3 liters) and heating to 35° C. for one hour; this does not impair the antitoxic value of the solution. Experiments have shown that the solution keeps its antitoxic properties for many months under the usual conditions prevailing in general practice.

Studies on rabbits have demonstrated that the tetanus antitoxin injected in the form of solution remains in the organism longer than when it is introduced by means of the usual antitetanic serum, and this seems to apply also to man. Unfortunately, the studies on man have been interrupted by the war. However, the first serological observations, which were made on 2 wounded subjects who had received either one injection of solution of antitoxin or two injections with an interval of several months, showed that the antitoxin was present in their organism for a relatively long time. It would seem that the antitoxin in the form of solution behaves like a substance which is more acceptable to the human organism and is more easily assimilated by it; hence, there is the possibility of its prolonged persistence in the circulation at a rather high titer, and probably also of a prolonged protection against the disease. In any case, this protection cannot be any lower or any shorter than that afforded by the usual antitetanic serum.

A comparative study of the anaphylactic manifestations in rabbits has revealed that successive injections of antitetanic serum produce more or less extensive eschars, while successive injections of the solution of antitoxin cause no reaction even if they have been preceded by an injection of serum. In guinea pigs, the solution of antitoxin was shown to be decidedly less sensitizing than the antitetanic serum when both had the same antitoxic titer; the power of the solution to precipitate general anaphylactic disturbances was also much lower than that of the serum.

These results have been confirmed in man by various authors who have used the solution of antitoxin to prevent tetanus in subjects who had not yet been vaccinated with anatoxin: in 150 observations they found that the percentage of serum reactions was negligible, notwithstanding the fact that a number of subjects had received an injection of horse serum some time previously and that some of them had presented more or less marked serum accidents on that occasion. To this must be added that during the past year thousands of injections of the solution of antitoxin have been administered in France and abroad and that not one serious accident has been reported

RICHARD KEMEL, M.D.

Kropp, B., and Smith, D. G.: Connective Tissue and Phagocytes in Experimental Gas-Gangrene Infection in Guinea Pigs; the Effect of Sulfanilamide. *War Med.*, 1941, 1: 682.

In gas gangrene the mobilization of leucocytes and other cells which have phagocytic properties is delayed or inhibited in the presence of the toxin of the gas-gangrene organism. This study was concerned with the investigation of the manner of action of the sulfonamides on the phagocytic picture. Gas gangrene was induced in the thighs of guinea pigs by the injection of clostridium welchii with sterile soil and muscle fragments. (In the treated animals 0.15 gm. of sulfanilamide was introduced at the time of infection.) Visual recognition of the phagocyte cells was aided by the subcutaneous injection of trypan-blue,

which the reticulo-endothelial cells took up. Animals were killed at varying intervals and given autopsy examination. Controls died usually in from twenty-four to thirty-six hours.

The most immediate effect of the infection was the involvement and destruction by the clostridium welchii toxin of the subcutaneous tissue and phagocytic cells present in the connective tissue. The organisms and toxin spread chiefly along connective-tissue planes. After connective tissue, skeletal muscle is attacked next. The toxin of clostridium welchii inhibits the accumulation and phagocytic activity of leucocytes and other phagocytes at the wound site.

Sulfanilamide introduced into the wounds partially overcomes the inhibitory action of the infection on the migration of leucocytes and phagocytic cells of the connective tissue as well as on the ability of the histocytes to phagocytose the clostridium welchii.

The processes in treated and untreated animals at different stages of the infection are illustrated by photomicrographs of histological sections.

EDWIN J. PULASKI, M.D.

Dowdy, A. H., and Sewell, R. L.: Roentgen Radiation in Experimental Clostridium-Welchii Infection (Gas Gangrene) in Dogs; Preliminary Report. *Radiology*, 1941, 37: 440.

The authors have been successful in establishing a fairly constant syndrome in dogs following the intramuscular injection of a twenty-hour unwashed subculture of clostridium welchii. Gas gangrene has been consistently produced in 66 dogs. The pathological process is not unlike the infection occurring in man, and is much more predictable in extent and toxicity than that seen in small animals.

Sixteen of 66 dogs were used for biological standardization; the remaining 50 were used as test animals. Twenty-five served as controls, and 25 received roentgen irradiation. The radiation technique varied in this preliminary study. In the majority of instances the individual dose was 100 roentgens (measured in air). Of the irradiated group, 16 animals died and the average survival period was forty-five and four-tenths hours. Of the control group, 20 died, and the average survival period was twenty-four and one half hours. Of the 16 irradiated animals receiving 1.25 cc. or more of the inoculum, 31 per cent survived. Only 12.5 per cent of the 16 controls receiving this amount survived. The use of 120 kvp. with a half-value layer of 3.55 mm. of aluminum, gives a survival of 41 per cent in comparison with 25 per cent for 200 kvp. with a half-value layer of 0.95 mm. of copper. An appreciable increase in survival rate resulted from treatment initiated within four hours after inoculation. The group of 20 survivors which had some degree of immunity were reinjected. One animal in the irradiated group, and 3 of the 10 in the control group, died.

The authors concluded that irradiation has been shown to have some therapeutic effect in combating clostridium-welchii infection.

HAROLD C. OCHSNER, M.D.

Kelly, J. F., and Dowell, D. A.: Twelve-Year Review of X-Ray Therapy of Gas Gangrene. *Radiology*, 1941, 37: 421.

The authors review the subject of post-traumatic gas gangrene treated by x-ray therapy. Of 364 patients so treated, 11.5 per cent died. In this group diagnosis was made on a clinical basis in only 93 patients, of which 17.2 per cent died; on the basis of clinical diagnosis and x-ray visualization of gas in the tissues in 41 patients, of which 17.3 per cent died; and on a basis of laboratory diagnosis in 207 patients, of which 8.6 per cent died. The mortality rate is therefore remarkably consistent regardless of the method of diagnosis.

In the statistics mentioned no case was included which did not have evidence of toxemia, nor was any fatal case excluded because there was a probable pretext for which it might be rejected. All reports on the roentgen-ray treatment of gas gangrene that have appeared in the literature with the exception of that of Coleman and Bennett have been favorable to the use of x-rays both as a prophylactic and therapeutic measure. Patients treated reasonably early and with the correct technique will respond favorably in most instances.

X-ray therapy of gas gangrene has made the use of serum unnecessary; serum may even be harmful to the diabetic who develops a gas infection. The authors believe that it has been proved quite conclusively that x-ray therapy and sulfanilamide should not be used at the same time in acute inflammatory processes. X-ray therapy has completely eliminated the necessity of extensive surgery as a means of treating gas gangrene during its acute invasive stage. The curative action of x-ray therapy in gas gangrene establishes beyond doubt the fact that this method is of value in treating infections, since gas-gangrene infections are uniformly resistant to other methods of treatment and respond consistently to x-ray therapy. HAROLD C. OCHSNER, M.D.

Torrey, R. G., Julianelle, L. A., and McNamee, H. G. The Sulfonamide Therapy of Staphylococcal Septicemia. *Ann. Int. Med.*, 1941, 15: 431.

The increase in the number of favorable results of treatment of staphylococcal septicemia with sulfonamides is cited but the conclusions are questioned as the diagnosis is often doubtful and many fatal cases are never reported. The diagnoses in the cases here reported are based on the growth of staphylococci from several daily blood cultures, usually with a colony count of the organisms. Later, tests of mannite fermentation and precipitation of the specific carbohydrate were done for confirmation. The sulfonamide was given in sufficient dosage. Only those cases receiving the drug at least from forty-eight to sixty hours were included in the study.

Nineteen cases were treated with sulfanilamide and in only 1 in which the diagnosis was questionable did the drug alone check the infection. Six patients recovered but antitoxin and anti-bacterial serum were used for supplementary therapy.

Sulfapyridine was used in 12 cases with 4 recoveries; all of the patients who recovered received anti-bacterial serum. This drug was considered ineffective. Only 2 patients received sulfamethylthiazole and both died.

Twenty patients received sulfathiazole and 7 of these recovered, but anti-bacterial serum was substituted for the drug. None of the rest was benefited.

Ten patients were treated with various combinations of these drugs with similar unsuccessful results. Four of these patients were treated also with bacteriophage, antitoxin, or antiserum and recovered but the remainder died.

In many patients septicemia developed from local areas while they were under treatment. Of the 62 patients treated 42 died; only 1 in whose case the diagnosis was doubtful recovered from drug therapy alone. Therefore, the mortality rate is high and agrees with that reported in cases under non-specific treatment.

In vitro studies on strains of staphylococci isolated from the blood in septicemia showed a marked lack of effect of sodium sulfathiazole on the organisms. Concentrations of 5,000 times that found in the blood stream were used. After twenty hours of incubation there was a great decrease in the number of organisms but the alkalinity of the solution may have accounted for this. A similar experiment with the bacillus coli resulted in complete sterilization in fifteen minutes.

The authors do not draw final conclusions from this small number of referred cases. The drugs seem to produce a temporary retardation of growth and thus help the tissues in overcoming the organisms. It is not believed that the sulfonamide drugs are strikingly effective in checking the majority of true staphylococcal septicemias.

HENRY P. ROYSTER, M.D.

Longacre, A. B.: Studies of the Antihemolysin Level in Patients with Staphylococcus Infections Treated with Staphylococcus Toxoid. *Surgery*, 1941, 10: 576.

Although the antihemolysin level of the blood does not measure the degree of immunity of the patient, it was used merely as a basis for comparison of results. The toxoid used was prepared by the action of pepsin enzyme on staphylococcal filtrates. Fewer reactions are encountered with this material than with that prepared by formalin. Twenty-five cases are presented. The diagnosis in 9 was chronic osteomyelitis; in 1, acute osteomyelitis; and in 15, soft-tissue staphylococcal infection. Reactions were few, the local ones being characterized by pain and swelling, and the systemic ones by slight malaise. In 1 case there was pyrexia and chilliness.

Diluted toxoid was used first, but a short time later a change was made to the concentrated form. The initial dose of the concentrated form was from 0.1 to 0.5 cc., and this was increased as rapidly as possible to 1 cc., usually by the third injection. The total dosage averaged from 6 to 8.5 cc. The majority of patients showed some elevation of the antihemolysin titer during the course of treatment. When a rise did not occur early, the toxoid administration was continued to a total of from 12 to 15 cc. The peak titer persisted only a few days in spite of continuation of the toxoid. The initial titers before therapy varied from 0.5 to 16 international units.

Among the chronic osteomyelitis cases an elevation of titer occurred in 9, with a maximum effect being noted in from three to forty days. One case was refractory. The average elevation over the initial titer was from 2 to 4 international units, the highest being 24. After treatment there was little evidence of clinical improvement. One patient was cured, but other therapy was also employed. In another, subjective symptoms disappeared when the titer remained high.

In the cases of soft-tissue lesions the titer elevation average was less than 3 international units, the maximum being 13.5 units. The maximum was usually reached in twenty-eight days from the start of the toxoid therapy. In this report, definite conclusions of clinical evaluation are not possible because of the short period of observation, but the results so far show that there were 4 recurrences and 11 probable cures, the rest being improved or without change. Although good results are found experimentally in rabbits, it is not possible to correlate the titer level with the clinical course in the human being.

HENRY P. ROYSTER, M.D.

Gastineau, F. M., Spolyar, L. W., and Haynes, E.: Sporotrichosis. A Report of 6 Cases Among Florists. *J. Am. M. Ass.*, 1941, 117: 1074.

Six cases of the lymphatic form of sporotrichosis are reported, each one occurring in a florist. In every instance the initial lesion followed a small prick of a finger which failed to heal, and then took a characteristic course.

Epidemiological study revealed that all patients had handled sphagnum moss and the organism "sporotrichum schenckii" was isolated from one specimen of the moss. This organism has been isolated from a number of widely different sources.

The disease is endemic in the Mississippi River basin and occurs primarily among agricultural manual workers. Its recognition is of importance since it is easily confused with tularemia, syphilis, tuberculosis of the skin, and chronic staphylococcal infections.

All patients in this study were cured by the administration of potassium iodide for several weeks.

HENRY P. ROYSTER, M.D.

Brunner, W.: Chemotherapy with Sulfamide Compounds with Special Consideration of Surgical Infections (Chemotherapie mit Sulfamidverbindungen unter besonderer Berueckschtigung der chirurgischen Infektionen). *Zentralbl. f. Chir.*, 1941, p. 482.

Domajk in 1935 disclosed that prontosil (sulfonamiddiaminobenzol) is effective against experi-

mental streptococcus infections. The azo-dye factors, especially chrysoidin, constituted the raw state. The sulfamidchrysoidin was introduced as prontosil rubrum to the trade. The next fundamental discovery was that of Tréfonel, Nitti, and Bovet, that the derivative of prontosil rubrum is an effective bactericide, that is, p-aminobenzolsulfonamide or sulfamide. The latter was presented to the market under 30 various names and was distributed by many firms. Substitution in the benzol nucleus was not efficacious. The substitution of hydrogen in the amino group diminished the toxicity but unfortunately influenced also the therapeutic effectiveness. The sulfamides are not equally effective against all bacteria. Prontosil and sulfanilamide are effective chiefly against streptococci, gonococci, and colon bacilli but to almost no degree against meningococci and pneumococci. Diseptal A or ulrion stood the test against gonococci but are too toxic and are now obsolete. Fewer secondary effects are experienced with neouliron or diseptal B. The author noted no effectiveness on staphylococcal infections.

Sulfapyridine represents recent progress; known in England as M & B 693, it is more effective than the preparations previously mentioned against pneumococci, meningococci, and gonococci, as well as against the other bacteria. The preparations are known in France under the name Dajénan, in Germany as eubasinum, and in America as sulfapyridine. Albucid (an acetylized sulfanilamide) is especially efficacious against gonorrhea. The Zurich University surgical clinic was bitterly disappointed in sulfapyridine as regards its secondary effects. The condition of the patients suffering from pyogenic infections was soon made worse and they disregarded it. On the other hand, the Clinic had a few striking successes in the treatment of generalized infections. As a result of their experiences one may rightfully use sulfanilamide, known also as prontosil album, protalbin, and sulfona, against streptococcal and colon infections. Only cibazol, also known as sulfathiazole, afforded them better results, chiefly against streptococci and colon bacilli; less so, but still better than the other preparations, against staphylococci, entrostreptococci and the bacillus pyocyaneus. In addition, it is better tolerated and does not exhibit such severe secondary effects. The mechanism is still not quite clear. Sulfanilamide is not effectively bactericidal *in vitro*, at least, not strikingly germicidal. Only sulfapyridine, as well as sulfathiazole, is more effective *in vitro* on pyogenic excitors. They, first of all, possess an inhibiting effect on growth, and are also bacteristatic, especially in generalized infections. All sulfanilamide products change the reaction state of the organism. The effects are definite as to phagocytosis.

The biochemical investigations of Fildes, Woods, Selbie, Green, Mellow, Locke, Shinn, Fox, Stamp *et al.* afforded new light on the question. The cells generate an important product of metabolism, p-amidobenzoic acid. This nullifies the bactericidal effect of the sulfanilamides. The bacteria also show it to be a vital metabolic product (metabolite). The bacteria produce a great number of such life-essential metabolic products which could be isolated. And so an indispensably necessary product for the staphylococci was isolated by Fildes and Richardson; it was identified through the S-H group. This became conjugated with mercury and the metabolite was withdrawn from the bacteria in question. Sulfanilamide has a similar effect. Of course, a certain antagonistic effect is also exercised on the metabolism of the body cells and it depends upon whether or not the host cells can withstand the inhibition long enough without too great injury. The effect, however, depends also on the sulfamide-checking substances; for example, novocaine inhibits the effect of the sulfamides. The latter depends on the oxygen available, that is, on the redoxpotential, and, indeed, the bacteristatic and bactericidal activity increases with elevation of the redoxpotentials. Their effectiveness is lost by complete oxygen withdrawal. Further, intermediary oxidation products of the sulfamides inhibit certain fermenting reactions whereby the vital state of the bacteria is injured.

Directions for surgical use. Streptococcic infections can doubtlessly be influenced chemotherapeutically. This is important as regards all war injuries in which the hemolytic streptococcus exercises a special role. The staphylococci, in contradistinction, are more resistant to chemotherapy. No clarification has as yet been reached as regards anaerobic infections. Bacteriologically, by continuous researches on preparations of pus it was possible to determine a diminution and failing of virulence of the streptococci. Cibazol is the most effective drug against pure pyogenic infection, whereas, in the anaerobic and putrid infections it merely serves as an adjunct to surgical measures. In addition, it is effective in lymphogranuloma inguinale and, perhaps, in actinomycosis. Chronic pyogenic infections are less well influenced. In diseases running a fulminating course only very intensive chemotherapy aiming at quick elevation of the sulfanilamide concentration in the blood is effective. It is natural that chemotherapy is more effective in less mutilating wounds than in such with extensive necrosis. The symptom of abscess formation can be so masked through the use of chemotherapy that its discovery may be difficult. Chemotherapy is, therefore, indicated especially in beginning phlegmons, simple lymphangitis, erysipelas, and in mere serosal inflammation of body cavities, as well as of tendon sheaths and joints. It makes almost no difference what specific bacteria is present. Severe locally walled-off abscesses should naturally be incised opportunely. Such is not the case in the early or beginning stages of infection; under such circumstances surgical intervention may be more harmful than good. It is a matter of clinical judgment.

Fundamentally, surgical measures are not made superfluous by the use of sulfamide therapy. In anaerobic infections one should administer serum

to supplement the chemotherapy. They complement each other very well as shown by animal investigations. Some 5 to 15 per cent of illnesses treated showed secondary reactions. They were generally harmless with cibazol, such as nausea, anorexia, and, a little less frequently, vomiting, headaches, and lassitude. With larger doses extended over many days, medicinal fever as well as exanthemata (chiefly small papules, frequently erythema exudativum multiforme or nodosa-like lesions, and less frequently, rubeoliform or scarlatiniform) were observed. Concomitantly episcleritis with mild conjunctivitis was noted. Even though the preparation is discontinued after a short time the patients react later against small doses as they have become hypersensitive. However, the clinic never observed cyanosis — methemoglobinemia, granulocytopenia, chronic or acute blood destruction, jaundice, or renal injury. However, sulfamide therapy is deprecated in cases of liver and renal insufficiency. There is still no conformity of opinion concerning the dosage or manner of use of the drug. The University Clinic at Zurich is guided by the study of the blood level. In mild infection the attained percentage should be 4 mgm. per cent; in severe infections 8 to 10 mgm. per cent; and in most severe ones from 15 to 20 mgm. per cent. The initial dosage should always be the greatest, as a rule from 0.03 to 0.04 gm. maximal, and exceptionally 0.05 gm. per kgm. of body weight; then a daily dose from 0.01 to 0.02 gm., exceptionally up to 0.25 gm. per kgm. It may be given orally, rectally, intramuscularly, or intravenously. In surgical cases in which oral therapy is frequently not possible the drug is given intravenously, that is, from 2 to 5 ampoules of sodium cibazol in each 1,000 cc. of physiological sodium chloride or glucose solution if one desires, to give a total of 3,000 cc. of fluid by constant infusion in twenty-four hours. A 2 per cent solution of sodium cibazol was frequently given which was made up with hydrochloric acid to a pH of 8.3, stabile at 35° C. This solution is especially adapted to subcutaneous administration as an enema as well as to injection in the infected pleural and peritoneal cavities, into the joints, and intralumbarly. Some surprising results were observed in a few instances following intra-arterial administration. Adults were given from 6 to 10 gm. orally on the first day; 1 or 2 gm. less on the second day, and on the following two to four days from 4 to 6 gm. The therapy is interrupted if the infection responds well within two or three days and if no relapse is to be expected after five or six days. In the remaining cases cibazol is not given orally longer than from ten to fourteen days. In chronic infections, 2 or 3 daily heroic doses are given orally. If one wishes to administer the drug over a longer period, then no more than 2 to 4 gm. should be given daily. Cibazol is used locally quite extensively. The results surpass all expectations. In infected wounds a 20 per cent borated cibazol powder is used. Prontosil sugar is no longer used. (Franz). H. H. Groskloss, M.D.

Long, P. H., Bliss, E. A., Ott, E., Trevett, G. I., and Nelson, R. A.: Studies on Sulfadiazine. The Chemotherapy of Experimental Hemolytic Streptococcal, Pneumococcal, and Staphylococcal Infections in Mice. Clinical Use of Sulfadiazine in the Therapy of Bacterial Infections, Other Than Pneumonia. *Bull. Johns Hopkins Hosp.*, Balt., 1941, 69: 297, 303.

The authors, in a series of two articles, report on the clinical use of sulfadiazine in the therapy of bacterial infections in experimental animals and in man.

The study was conducted in a manner to observe the comparative therapeutic efficiency of sulfadiazine and other sulfonamides when administered orally. In the pneumococcal infections, the effects of sulfadiazine were compared with those of sulfapyridine and sulfathiazole. In streptococcal infections, sulfadiazine was compared with sulfanilamide, and in staphylococcal infection with sulfathiazole.

The interesting points which were brought out were, first, that sulfadiazine is an effective chemotherapeutic agent for control of experimental hemolytic streptococcal, staphylococcal, and pneumococcal infections in mice. Second, when equivalent blood concentrations of the drugs were compared, sulfadiazine was found to be as effective as sulfanilamide in streptococcal infections and as effective as sulfathiazole in staphylococcal infections, but less effective than sulfathiazole in pneumococcal infections.

The inferiority of sulfadiazine to sulfathiazole in the last instance is offset by the greater ease with which relatively high blood concentrations can be produced and maintained without ill effects or injury to the tissues.

The second study considers the absorption, distribution, and excretion of sulfadiazine when administered orally to human beings, and restricts itself to bacterial infections other than pneumonia. It was noted that a rise in the concentration of the drug in the blood was not as rapid as that which followed the administration of sulfanilamide and sulfathiazole, a fact that should be considered when acutely or seriously ill patients are treated. Sulfadiazine is absorbed rather slowly, and the apparent better maintenance of the concentration of sulfadiazine in the blood is due to the fact that sulfadiazine is excreted less rapidly than the other sulfonamides. It was likewise pointed out that sulfadiazine in its manner of absorption resembles sulfapyridine more closely than it does sulfanilamide or sulfathiazole, and that following the single oral dose of the drug somewhat less than half is excreted within the first twenty-four hours. Total excretion of that portion of the drug which has been absorbed may not be complete for about five days.

Considerable experience was accumulated in the use of sulfadiazine in the treatment of beta-hemolytic streptococcal infections such as tonsillitis, erysipelas, otitis media, scarlet fever, and the like. And it was possible to work out a dosage scale for these types of infection. The use of the drug was encouraging in

meningococcal meningitis, as well as in subacute bacterial endocarditis, although the number of cases was small. Twelve patients suffering from staphylococcal infection made a gratifying response to sulfadiazine therapy and demonstrated that long-continued use of the drug was possible. The prominent feature of sulfadiazine therapy, it was observed, has been the great ease with which the relatively high concentration of sulfadiazine can be maintained in the blood as well as the notable infrequency of toxic manifestations encountered. This suggested that even higher blood concentration might be maintained than has been the practice with the other sulfonamides and consequently a relatively greater therapeutic response could be expected.

It was concluded that sulfadiazine was well tolerated and appears to be the best available drug for the treatment of chronic bacterial infections requiring long-continued therapy.

STEPHEN A. ZIEMAN, M.D.

ANESTHESIA

Burford, G. E.: Involuntary Eyeball Motion During Anesthesia and Sleep; Relationship to Cortical Rhythmic Potentials. *Anes. & Anal.*, 1941, 20: 191.

One of the most useful signs observed during the administration of anesthesia is a slow movement of the eyeballs. This movement, usually from side to side across the palpebral fissure, serves as a relatively constant pathognomonic sign of light anesthesia. Activity gradually decreases with increased depth of narcosis until it finally ceases.

A partial understanding of this phenomenon is developed from the following points:

A spontaneous neurone beat arises during the resting state somewhere within the visual mechanism when the retina is unstimulated. This condition is favored during sleep and anesthesia. The beat may originate in any one of several possible places. The resulting electrical disturbance is eventually carried as a stimulus, by way of the optic connecting pathways, to the nuclear column controlling eyeball motion. This stimulus is able to affect the nucleus on each side differently, possibly as a result of its slow subtetanic intensity. Timing irregularities in the arrival of the stimulus at the nucleus on each side may occur as a result of the wide ramifications of the optic pathways. Hence the stimulus frequently differs on each side and effects a fractionated response at the nuclear column, capable of producing the peculiar slow, frequently asymmetrical, motion of the eyeballs, which is characteristic of sleep and anesthesia.

This motion cannot be induced voluntarily, and is, in all probability, a form of autonomic activity. There is no evidence suggesting a sympathetic origin. The evidence deduced by the authors consists of:

1. A known parasympathetic outflow for pupil constriction is coursing the oculomotor nerve during the same time that muscular activity, concerned with eyeball motion, is occurring.

2. Many non-myelinated nerve endings terminate in the eye muscles. These are of controversial origin, and at least remain intact after sympathetic degeneration has occurred. The eye muscles themselves differ in many respects from ordinary skeletal muscles.

3. Persistent irregular activity as typified by involuntary eyeball motion is characteristic of the autonomic system.

4. Parasympathetic outflow in general is active during sleep.

5. The motion is obviously involuntary, and there is no evidence relating it to sympathetic activity.

It is believed that the existence of eye movements during the conditions under which cortical action current records are most readily obtained, has not been given the attention by neurophysiologists that it may deserve.

There is a definite meaning to the decrease of eyeball motion during deepening anesthesia. It signifies that as narcosis deepens, the resulting depression is affecting the origination and the conduction of impulses within the central nervous system.

HOWARD A. MCKNIGHT, M.D.

Sachs, L.: The Relation of Anesthesia to the Development of Secondary Shock. *Anes. & Anal.*, 1941, 20: 200.

The modern conception of shock is that there is a loss of blood elements corresponding to plasma at the site of the trauma. With this as a basis, the author undertook an investigation of the blood concentration and reaction of patients under various anesthetics. He concludes that ether, avertin and ether, spinal, nitrous-oxide and oxygen, and caudal anesthesias, in use during ordinary major operations, do not influence the plasma proteins, hemoglobin, or blood pH. Interpreting these findings in the light of conclusions reached by Blalock he is convinced that the anesthetics studied play no part in the development of secondary shock.

HOWARD A. MCKNIGHT, M.D.

Engel, R., Phemister, D. B., and Livingstone, H.: Splanchnic Anesthesia. *Anes. & Anal.*, 1941, 20: 261.

Engel, Phemister, and Livingstone believe that anterior splanchnic nerve-block anesthesia should receive more consideration in this country. The splanchnic nerve-block will not only produce analgesia and relaxation of the intestines, stomach, kidneys, suprarenals, and pancreas, but will also affect the cardiovascular and metabolic functions of the entire organism, because of the mixed character of the splanchnic nerve fibers. The approach to the splanchnic nerves from the front through the open abdomen as described by Braun has proved to be a safe and adequate method for operations in the upper abdomen.

The special indications for this type of anesthesia are cholecystectomies, and gastric, splenic, and pancreatic operations. It is most desirable in aged patients or those with pulmonary or cardiovascular diseases, severe anemia, or cachexia. It is considered contraindicated in all abdominal exploration, lower abdominal operations, peritonitis and intestinal obstruction, or in very obese patients.

The authors performed 51 operations under anterior splanchnic block with the following results: 8 anesthetic failures, 8 with partially satisfactory anesthesia, and 35 with adequate anesthesia. The reactions during operation were relatively inconsequential. The smoothness of the postoperative course and the low incidence of serious complications are the outstanding advantages of splanchnic anesthesia. The hazards of this type of anesthesia are considered very low if intravenous injection is avoided. The method used by the authors is essentially that described by Finsterer. The abdominal wall is infiltrated with novocaine and a small incision is made. The left hand is introduced and the index finger is pressed against the body of the twelfth thoracic vertebra, thus separating the aorta and the inferior vena cava. The needle is then introduced along the radial edge of the index finger until it reaches the vertebra. The needle is tried to ascertain whether or not a small vein has been punctured. If no aspiration occurs, 50 cc. or more of ¼ to ½ per cent novocaine-adrenalin solution is injected.

STEPHEN A. ZIEMAN, M.D.

Nicholson, M. J., Eversole, U. H., and Hand, L. V.: Fractional Spinal Anesthesia. *Am. J. Surg.*, 1941, 53: 403.

The authors describe their technique and experiences with fractional (continuous) spinal anesthesia at the Lahey Clinic. This method of producing prolonged spinal anesthesia employs procaine hydrochloride, which is administered into the subarachnoid space in fractional doses as needed during the operation. A specially designed mattress and a very flexible German silver lumbar puncture needle (18, 19, or 20 gauge), which is allowed to remain *in situ* during the operation, are the only special apparatus required. The needle is connected to a syringe by means of rubber tubing, with air-tight and water-tight connections.

After trying procaine, nupercaine, metycaine, and pontocaine, the authors concluded that procaine, which has the briefest action of the group, was the best suited for this method of administration. Various concentrations were tested and 3⅓ per cent solution in normal saline solution was found to be most satisfactory. The solution produces anesthesia in from three to five minutes and as each 3 c.cm. contains 100 mgm. of procaine, calculation of the total amount used is simplified. Fifty milligrams of ephedrine sulfate is given routinely as part of the local anesthetic in the site selected for lumbar puncture.

The present study consists of 126 cases in which surgery was performed under fractional spinal anesthesia. The authors prefer intravenous anesthesia of sodium pentothal, given by intravenous drip in conjunction with adequate oxygen as a supplementary anesthesia, to cyclopropane ethylene or ether because it eliminates the hazard of explosion in the presence of the actual cautery or the high-frequency electro-coagulating unit.

As anesthesia wears off during an abdominal operation and sensory and motor function starts to return, the patient complains of vague discomfort and then pain as the muscles grow tense. The addition of from 35 to 50 mgm. is usually sufficient to produce relaxation. The duration of the operative procedure in this series varied from a few minutes to four and one-half hours. All types of operations below the diaphragm were included. Only 2 minor complications occurred. One patient had severe headache for five days and another complained of sciatica for three weeks.

The authors recommend fractional spinal anesthesia in: (1) long, difficult operations, such as subtotal gastric resection for ulcer; secondary operations on the biliary tract; and large bowel resections; and (2) those cases of undeterminable length, such as abdominal exploration with the problem of gastric resection, dilatation, and curettage, that may be followed by hysterectomy and exploration.

JOHN A. GIUS, M.D.

Störtebecker, T. P.: Combined Evipan N_2O Anesthesia. *Acta chirurg. Scand.*, 1941, 85: 299.

This article concerns a method of general anesthesia, consisting of the prolonged intravenous administration of the barbiturate evipan combined with gaseous nitrous-oxide inhalation.

In many lengthy surgical procedures the administration of nitrous oxide-oxygen alone is not sufficient to produce deep anesthesia with complete muscular relaxation, and it is therefore necessary to supplement it with another anesthetic. The use of ether anesthesia is steadily declining, as it does not fulfill the requirements of a good anesthetic.

The preliminary oral administration of various sedatives and soporifics makes the gas anesthesia more effective and enhances relaxation, but still the anesthesia produced will often be insufficient. The author recommends the use of a combination of evipan given intravenously and nitrous-oxide-oxygen inhalation.

The method described is principally as follows:

The anesthesia is begun with the intravenous administration of evipan, a dose just sufficient to put the patient to sleep being given. The anesthesia is continued by the gaseous administration of nitrous oxide plus oxygen until true anesthesia is obtained. During the progress of the surgical procedure intermittent doses of evipan are administered as often as is needed to intensify the anesthesia.

Evipan (sodium N-methyl-CC-cyclo-hexenyl-methyl barbituric acid) is procured in ampules, each containing 1 gm. of powder substance, which is dissolved in 10 c.cm. of distilled water immediately be-

fore use. The author always uses a freshly made solution, as it cannot be kept more than a few hours, because this barbituric compound rapidly dissimilates when exposed to the air.

The author stresses the fact that he has found no disadvantages with 10 per cent solutions when they are administered according to strictly individual intermittent dosage.

The 10 per cent evipan solution is kept in a 10 c.cm. excentrically tipped syringe equipped with a common puncture needle. It is usually injected into the ulnar vein, at the rate of 1 c.cm. in thirty seconds, i.e. 2 c.cm. per minute.

As the anesthetic is slowly injected, the patient is asked to begin counting from 1, slowly and loudly.

The injection of evipan must be made slowly and continuously to be a steady infusion, not by small jerks. It is continued until the patient ceases to count, having fallen asleep. The dose of evipan hitherto consumed is called the sleeping dose.

When the patient has received the sleeping dose and ½ or 1 minute has passed, a further 1 c.cm. of evipan is injected at a still slower rate. Then the syringe is kept in the same position with the needle in the vein for the further administration of evipan. During the whole operation one person must be solely occupied with the evipan injection.

The anesthetist now continues the anesthesia by the administration of nitrous oxide plus oxygen gas inhalation. The author points out that the technique of applying gas anesthesia is much easier if the patient is already anesthetized by means of evipan than when anesthesia is induced with nitrous oxide alone.

Before beginning the surgical procedure nitrous oxide plus oxygen is administered for from five to ten minutes to attain complete anesthesia, which is judged by means of the reflexes. The total amount of evipan injected up to this point is briefly called the starting-surgery dose. If the depth of anesthesia appears to be unsatisfactory at the starting-surgery dose of evipan and nitrous oxide it can easily be augmented by the further administration of evipan; another ½ c.cm. of the evipan solution may be injected. In this way the anesthesia may be carried out by intermittent injections of evipan solution into the vein as needed and for as long periods as are necessary.

The strictly biological individualization of the dosage of evipan, as well as of nitrous oxide, is strongly emphasized; consequently no previously fixed scheme can be followed.

The patient recovers promptly from the anesthesia, being fully awake within two or three minutes after the administration has been stopped. Nausea is much less marked than after ether. Vomiting is very rare, and when it occurs is only insignificant. The author has never seen the persistent attacks of vomiting usually observed subsequent to ether. The patient awakens quite calmly, without any excitement of struggling. SAMUEL H. KLEIN, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Welin, S.: Roentgen Diagnosis of Acute Otitis Media and Its Complications in the Temporal Bone (Beitraege zur Roentgen-diagnostik der Otitis media acuta und ihrer Komplikationen im Schlaefenbein). *Acta radiol.*, 1941, Supp. 42.

Welin's material includes all the confirmed cases of acute otitis media referred for examination to the Roentgen Institute of the University clinics of Lund from 1934 to 1939, inclusive, and cases clinically suspected of apicitis. Clinical signs of mastoiditis were present in some of the cases of acute otitis media and absent in others. Of the 926 patients examined, 338 had otitis media on the right side, 362 on the left side, and 226 had it on both sides; the total number of ears examined and presenting pathological changes was 1,152. The age of the patients varied greatly, but the tabulation of the cases confirmed the old concept that the disease appears more frequently during childhood than at a later age: 51 per cent of the patients were in the first decade of life, and 48 per cent of the antrotomies were performed in this age group. Antrotomy was found necessary in 462 patients; the remaining 464 recovered without any intervention or after one or more paracenteses. The number of roentgen examinations was 1,581; control examinations were made only in cases in which they were indicated by changes in the clinical picture, or in which the first examination suggested the possibility of a progressive pathological process.

In addition to the symmetrical projection according to Altschul, the author has used Runstroem's technique since the end of 1933. The value of the symmetrical projection has long been doubted, but the more recent refinements of roentgen technique which allow obtaining impeccable pictures have favored this projection. For this projection the patient is placed in dorsal decubitus with the chin pressed against the chest; the head is fixed in symmetrical position with the central ray passing through the middle of an imaginary line connecting the two mastoid processes; and then the roentgen tube is shifted craniad 35 degrees. This projection allows comparison of the condition of the two temporal bones: a slight difference in the air content of the cell system of the two bones or a reduction in the calcium content of the periantral region is clearly shown. If pneumatization is inhibited, a good idea of the size of the antrum is obtained, and the thickness of the corticalis is directly observed in all cases; the sublabyrinthine cells and the auditory tubes are seen more distinctly than in any other picture. The four projections described by Runstroem are taken stereoscopically with the patient lying down to make sure of his immobilization. The stereoscopic pictures are of great diagnostic aid and reveal numerous peculiarities which cannot be interpreted in the single film.

The author reviews the literature on pneumatization and the factors which influence it: all writers agree with Witmaack that pneumatization depends on both idiotypic and paratypic factors, but they disagree on what group of factors has the greatest importance. As to the value of the roentgen findings and the frequency of occurrence of the various forms of pneumatization in some selected clinical materials, it would seem that the inflammatory processes in the ears with small cell systems are predestined to become chronic, while a more extensive pneumatization is usually found in cases of acute otitis media. According to some authors, the latter cases also present inhibited cell systems although they are three times larger than those found in chronic otitis; however, all writers agree that the significance of the extent of the cell system should not be overestimated. Hesse thinks that complicating mastoiditis occurs more frequently in cases with marked hypoplasia of the mucosa and with small reduced cell systems, while Stix and Barth found that the extensive cell systems were most frequently associated with mastoiditis; according to Wirth, this applies especially to the irregular cell systems.

In Welin's material of acute otitis media, all types of pneumatization were represented, but the majority of the patients (61 per cent) had cell systems of normal extent; the frequency of complicating mastoiditis stood in direct relation to the extension of the cell system, while the irregular cell systems showed a certain degree of predisposition to mastoiditis. Certain cell groups present a special roentgen clinical interest: they are the sublabyrinthine, zygomatic, and petrous bone cells. The more extensive the pneumatization of the apex, the more favorable the conditions for apicitis: a certain degree of pneumatization of the apex was found in 23.6 per cent of the present material, while complete pneumatization was observed in 4 per cent and was equally distributed among both sexes. Pneumatization of the apex occurs by various routes from the tympanic cavity and the antrum. The translabyrinthine connection, which is supposed to be rare, was found in 11 of the 15 cases of apicitis and also in cases in which no destructive process of the apex was present. There were 3 cases of early meningitis: in all there was a cell system corresponding best to a hyperplastic mucosa; no signs of bone disease were observed. There were also 8 cases in which meningitis occurred later, but it was naturally impossible to decide with certainty whether this complication was secondary to the otitis.

All cases have shown a diffuse decrease in air content, but no conclusions regarding the severity of the inflammatory process can be drawn from the depth of the shadow. Deepening of the shadow demonstrated by serial roentgen examinations indicates an advance in the pathological process, although the

advance does not have to be significant enough to require antrotomy: therefore, these cases must be kept under continuous clinical or, better still, roentgen observation. The presence of a diffuse shadow from the beginning of the disease does not allow drawing conclusions regarding the malignancy of the inflammatory process. A decrease in the calcium content was found in the roentgen pictures of 206 cases: whether this decrease is diffuse or localized in a small limited region, it is usually demonstrable with the present roentgen technique. A beginning pathological change in the septum of the cells appears in the roentgen picture as a decrease in their calcium content. Because of the demonstrable histological changes, this finding should be regarded as a severe disorder of the bone. This change is diagnosed earlier in the less developed stages when it occurs superficially rather than in the depth of the cell system; in certain cases, it can be demonstrated at the end of the first week of the disease. This finding imposes the necessity of continuous roentgen control because at times the inflammatory process may progress in the cell system while the remaining clinical examinations suggest improvement. In large terminal cells, a decreased calcium content of the neighboring cellular trabecules indicates a retention. The demonstration of a decreased calcium content is of decisive importance for the differential diagnosis between a large cell and a local degeneration. A local destructive process was found in 106 cases. Local degeneration, which is revealed by complete absence of cell trabecules and decreased calcium content of the neighboring septa, may occur in all types of pneumatization and anywhere in the cell system. The roentgen finding of a local focus of degeneration shows that serious consideration must be given to operation; the indication for intervention is absolute when the focus is located close to the sinus, dura, labyrinth, or facial nerve. In the presence of clinical signs of a zygomatic mastoiditis, there are roentgenologically demonstrable pathological bone changes in the zygomatic process in some cases, and none in others; there are also cases with bone changes showing in the roentgenogram and at operation, but without clinical signs of zygomatic mastoiditis. The roentgen demonstration of sublabyrinthine degeneration is of great importance because this process may easily be overlooked during antrotomy.

Epidural abscess is denoted in the roentgenogram by a marked clearing of the cortical bone in contact with the dura. A defect in the contour of the tympanic roof is consequently not necessary to make a certain diagnosis. An abscess around the sinus is revealed by the clearing which it causes in the bony wall surrounding the sinus. There are four different typical pictures; they depend on the location of the abscess with regard to the posterior border of the pyramid. This complication may be found in all types of pneumatization. The roentgen diagnosis fails in anomalies in which the wall of the sinus is originally very thin or defective; in exposure of a sinus of a size smaller than that of a grain of rice; when the sinus exposure occurs at the bulb of the jugular vein; in small children, because of the slight difference in contrast between the defect and the sinus wall. When apicitis is suspected clinically, roentgen examination may confirm or exclude its diagnosis; in the presence of positive findings, the roentgenogram can show by what cellular route the infection has passed from the mastoid to the apex; it can also give the anatomical data which will guide the choice of the surgical method to be used; it can demonstrate the presence of some sequestrum.

The antrum and the beginning development of the cells are roentgenologically demonstrable at birth, and roentgen examination in acute otitis media of nurslings and small children gives reliable and valuable information. RICHARD KEMEL, M.D.

Melot, G. J.: Roentgenological Examination of the Soft Tissues. Technical Considerations. Study of the Axillary Region. *Am. J. Roentgenol.*, 1941, 46: 189.

In roentgenography of the soft tissues many technical difficulties are encountered as the result of the small differences in the absorption power of those tissues. The author briefly reviews the work done by others both with and without contrast media to render the procedure satisfactory for practical purposes, and reports personal attempts along that line. Experimental work to develop a technique without the use of contrast media and with apparatus in general use is described in detail.

In summarizing the results it is stated: "A roentgenogram is taken under a graduated aluminum filter. From this test film, the filter thickness giving the best contrast for each patient is chosen. Tension and milliamperage are practically the same as those employed for roentgenograms of bone. The variable factor is, therefore, not kilovoltage, but filtration."

Studies of the axillary region were made both of autopsied sections and of patients with normal and abnormal conditions. These are described and illustrated. ADOLPH HARTUNG, M.D.

Hartung, A., and Grossman, J. W.: Hernia of the Lung. *Am. J. Roentgenol.*, 1941, 46: 321.

The authors observed a case of hernia of the lung in a colored boy ten years of age. In this report they give a short review of the subject and describe the case briefly.

Hernia of the lung is quite rare, only about 200 cases having been recorded in the literature. According to Morel-Lavallee, it may be congenital or acquired, with the latter type subdivided into the traumatic, spontaneous, and pathological group. On the basis of location they may be classified as (1) diaphragmatic, (2) intercostal, and (3) cervical, although the diaphragmatic herniation is considered by many, because of the pressure relationship involved, as occurring only from the abdomen into the chest, and not *vice versa*. The authors' case would be classified as the acquired traumatic intercostal type.

The important findings in the case were: (1) a faintly visible depression in the anterior chest wall in the sixth interspace during quiet inspiration; (2) a palpable defect in the interstitial tissues at the same place; (3) a bulging of the size of a small hen's egg protruding from the defect on forced expiration with the glottis closed (Valsalva procedure); (4) free movability of the skin over the bulging; (5) a negative roentgenogram on quiet respiration; however, there was a definite area of radioluscency in the posteroanterior view and projection of the lung beyond the normal boundary in the oblique view during the performance of the Valsalva act.

T. LEUCUTIA, M.D.

Wasson, W. W.: A Study of the Gastro-Intestinal Tract of Children and Its Relation to the Adult. *Radiology*, 1941, 37: 277.

Although adequate information relative to both the infant and adult gastro-intestinal tract is available, correlation in the study of the two is lacking. The author briefly points out some of the differences in the anatomy, physiology, and pathology of various age groups. He believes further studies, especially by roentgen examination of the intermediate group between the young child and the adult, will be valuable particularly in furthering our knowledge of the progression of the gastro-intestinal tract from early childhood into adult life. Such knowledge would offer some hope for the prevention of many of the diseases of adult life and the production of healthier people. ADOLPH HARTUNG, M.D.

Feldman, M.: A Roentgenological Consideration of the Normal Mucosa of the Duodenum. *Radiology*, 1941, 37: 284.

The roentgen method of examination offers the best and most accurate means of appraising the interior of the duodenum This presentation is primarily concerned with the ampullary portion of it and calls attention to the need for such studies to establish roentgenological criteria for the diagnosis of early pathological conditions. Because of the rapid progress of the opaque meal through the second part of the duodenum, details are best observed in serial roentgenograms, preferably without compression. Compression may at times be necessary to delineate minute changes clearly. Fluoroscopy does not as a rule portray the finer details with clarity.

The anatomy of the duodenum is given brief consideration. The interior of the first portion normally presents from four to six low, shallow, longitudinal folds, which at times may be seen to pass into the descending duodenum. The mucosa of the other parts of the duodenum reveals some findings resembling those in the rest of the small intestines, i.e., transverse circular folds encircling the lumen either completely or partially and running approximately at right angle to the long axis or spirally.

In addition to these common characteristics the second portion of the duodenum presents appearances of special interest because of structures within it. The plica longitudinalis may be demonstrated roentgenologically in a small percentage of cases in a relief view of the interior of the duodenum. This fold is portrayed as a single longitudinal negative shadow. At its beginning it appears to be shallow, but it becomes more prominent at the ampulla, as it approaches the papilla. The normal plica longitudinalis varies from 4 to 6 mm. in length and from 2 to 4 mm. in width. Some of the transverse folds may be seen to cross it, while others seem to end abruptly here. The normal major papilla can also be demonstrated at times in the mucosal relief view. It presents itself as a small negative shadow of smooth round contour, varying from 3 to 5 mm. in diameter, in about the center of the ampullary portion of the duodenum, in the mesial aspect. On close observation the circular hood-like fold surrounding the papilla may occasionally be seen in the lower end of the plica longitudinalis.

Of importance, too, is the roentgenological demonstration of longitudinal folds other than the single broad plica longitudinalis. In the onward movement of duodenal peristalsis caudalward, longitudinal folds are frequently observed in small segments of the duodenum. These folds are multiple, numbering between five and ten, and may be seen at times extending from the superior portion of the duodenum into the descending segment. They may be seen in all parts of the duodenum. They are usually observed in short segments with intervening transverse folds. The folds are short, shallow, thin, evenly distributed, and are easily obliterated. ADOLF HARTUNG, M.D.

Baird, L. W.: Roentgen Irradiation of Calcareous Deposits About the Shoulder. *Radiology*, 1941, 37: 316.

The author considers roentgen therapy the treatment of choice in all acute and most subacute stages of calcified subacromial bursitis. At the Scott and White Clinic of Temple (Texas) 44 cases were observed from 1937 to 1940, 18 of which were treated by irradiation. Of these, 9 were acute, 5 subacute, and 4 chronic.

The factors of treatment were as follows: 300 roentgens (in air) in a single dose through a 15 by 15 cm. cone, angled slightly toward the body over the anterior-lateral portion of the shoulder, with the central ray passing through the acute point of tenderness, 200 kv. constant, 1 mm. of copper and 1 mm. of aluminum, 18 ma., and 50 cm. distance.

Only one exposure was required for complete relief of the pain and normal restoration of function in the 9 acute and 2 of the subacute cases. The symptoms as a rule disappeared within seventy-two hours. Checkup roentgenograms showed disappearance of the calcium deposits in all instances with the exception of 1. In 3 the deposits had disappeared within forty-eight hours.

In the remaining cases, the treatment was repeated at intervals of from three to four weeks. The 3 other subacute cases responded with complete relief of symptoms and disappearance of the

calcareous deposits within two weeks following the second treatment. Likewise, good results were obtained in 2 chronic cases after 3 treatments repeated at four-week intervals. In 2 chronic cases, there was no response.

The action of roentgen irradiation in calcified subacromial bursitis is similar to that observed in other inflammations. In the chronic cases, the changes consist mostly of fibrosis and adhesions, and therefore irradiation produces no effect.

T. LEUCUTIA, M.D.

Klein, I., and Klemes, I. S.: Treatment of Peritendinitis Calcarea in the Shoulder Joint. *Radiology*, 1941, 37: 325.

Roentgen therapy is the best method of treating peritendinitis calcarea of the shoulder joint since it produces speedy relief of the distressing symptoms followed by absorption of the calcareous deposits. The authors' experience includes 52 cases treated by physiotherapy from 1932 to 1936 and by roentgen therapy from 1937 to 1940. These cases are presented in tabular arrangement. The average disability with physiotherapy was fifty days and with roentgen therapy ten days.

The physiotherapy consisted mostly of diathermy and infra-red therapy. The roentgen irradiation was carried out with the following factors: from 75 to 100 roentgens (in air) every three to seven days for four doses; 120 kv., 4 mm. of aluminum, 5 ma., 30 cm. distance, and field 8 by 8 cm., or 180 kv., 0.5 mm. of copper, 1 mm. of aluminum, 4 ma., 40 cm. distance, field 10 by 10 cm.; the choice depended on the thickness of the shoulder. The second course, when found necessary, was given about one month after the first with the same technique.

Five case histories are included in short résumés to illustrate the good results obtained.

T. LEUCUTIA, M.D.

Mueller, W.: The Results of X-Ray Treatment of Puerperal Mastitis; 235 Cases (Die Erfolge der Roentgentherapie bei Mastitis puerperalis; 235 Faelle). Hamburg: Dissertation, 1940.

Puerperal mastitis afflicts almost exclusively the actively nursing mothers. The mastitis occurs, in the majority of cases, between five and fourteen days post partum. It is chiefly a staphylococcus infection, being far more rarely caused by the streptococcus. A differentiation between parenchymatous and interstitial mastitis is generally not determinable because the inflammation very promptly disseminates from one tissue to the other. The parenchymatous inflammation occurs very chiefly because of milk statis, and it generally affects only one lobe; however, interstitial mastitis which originates in the fissure of the nipple, extends chiefly in a diffuse manner. The diseased parenchyma of the gland melts rapidly and soon becomes destroyed and functionless. Therefore, it is important to start the treatment early.

Primiparas are especially endangered by mastitis traced immediately to milk stasis; and, in addition they more readily acquire fissures of the nipple than multiparas. Blonds, and more especially red-blonds, are susceptible. Washing with cold water, drying with bath towels, and massage with ointment serve as prophylatic treatment. Since 1930, weak x-ray irradiation has been employed in a woman's clinic in Danzig for the treatment of mastitis, especially in early, beginning mastitis. It was possible to heal the lesions without surgical interference and all other additional therapeutic measures in 88 per cent of the cases of beginning mastitis. Altogether 370 women with puerperal mastitis were subjected to x-ray irradiation: Granzow (*Med. Klin.*, 1931, 2: 1201) reported the first 21 cases; Theiss again reported these and an additional 114 cases (*Zentralbl. f. Gynaek.*, 1035, 2: 1644). The author reported 235 additional cases from May, 1935, to April, 1938. Of these 235 cases 158 were incurred in the clinic, 19 were ambulatory, and 58 were referred from the outside. The results were as follows:

	No.	Incision No.	Incision (%)	Good Result (%)
Clinical cases.....	158	19	12	88
Ambulatory cases...	19	8	42	58
Referred cases.....	58	36	62	38
Total cases.....	235	63	26.81	73.19 (172)

Of the 63 patients, in whom it was necessary to employ an incision, only 19 were irradiated early (within twenty-four hours), 7 were irradiated late (within forty-eight hours), and 37 were irradiated very late (after days and weeks). If one subtracts these 44 late-irradiated cases, the total good results amount to 88 per cent. The leucocyte counts were between 10,000 and 20,000, and over. Low temperatures in the beginning and slight general malaise did not obviate a later severe course.

As it is not always possible to differentiate a beginning mastitis from a simple milk-stasis, even a suspected mastitis should be prophylactically irradiated. There should be no concern over transporting a puerperal woman for ambulatory treatment. The irradiation factors were 180 kv. and 6 ma., filters of 0.5 mm. of copper, and 3 mm. of aluminum, a distance of 40 cm. between the filter and the skin, an 8 by 10 or 10 by 15 cm. field and 10 per cent skin erythema dose (HED) (amounting to a total of 550 roentgens); rarely was only a 5 per cent dose used; a 20 per cent dose was the largest used. The healthy neighboring tissues were irradiated over a circumference of 3 to 4 cm. In opposition to Wintz, who applied 40 per cent HED to quiet the function of the gland, it was considered an especial advantage that with small doses the secretory function was in no way impaired.

In 205 cases only one irradiation was used; in 27 cases, 2 were used; and in 3 cases, 3 were used. A second irradiation was used chiefly in those cases in which there was another section of the breast involved by a new infiltration of the infection, or in which a more rapid melting process was necessary. Also many other authors enjoyed very good results with weak irradiation. The irradiation sensibly eases

the pain immediately. The temperature, as a rule, falls critically. Almost regularly an extensive fiery erythema of the skin which jags out into the healthy neighboring regions occurs soon after irradiation. There is clearly an arterially active hyperemia which is a very important factor in respect to healing. After forty-eight hours the total leucocytes generally fall to a normal level; otherwise it is necessary to cope with a melting-away process which is further increased by a second irradiation. In only 1 case, in a woman who in each of her 3 previous births suffered a mastitis, was there encountered a late recurrence. A later follow-up of similarly treated women showed that no injury to the lactating nipple occurred; a few of the women even observed an increased function. Of 65 women who reported with a later pregnancy, 52 failed to notice any difference in function of the gland; 6 reported decreased activity; 7 increased activity; in 14 women mastitis occurred during a subsequent pregnancy.

(Hintze). H. H. Groskloss, M.D.

Daland, E. M.: The Surgical Treatment of Post-irradiation Necrosis. *Am. J. Roentgenol.*, 1941, 46: 287.

Postirradiation necrosis may be due to carelessness or faulty technique, to ligation or disturbance of the blood supply of an irradiated area, infection reaching this area, or undue prolongation of therapy after tissue changes are evident. In general, the surgical treatment consists in the radical removal of all the necrotic tissue with a wide enough margin to insure an adequate circulation. Removal of the central area of necrosis may give relief from pain but granulations will not appear and flaps will not "take" unless normal tissue is exposed around the periphery.

There are times when it is advisable to do no active surgery for necrosis. This applies to regions where bone or fascia cover important tissues and removal of these materials will expose structures which cannot be covered. Exposed bone which can be kept dry may sometimes need no treatment. Several cases are cited by the author, in which this procedure was followed.

Necrosis of cartilage, of the skull, and of the jaw is given special consideration and illustrative case histories are included. Attention is called to the value of electrocoagulation for the removal of necrotic areas in some instances. Emphasis is laid upon the need of oral hygiene in connection with lesions about the mouth before irradiation, and the dangers associated with oral surgery for some time after such irradiations.

In view of the extreme fibrosis and endarteritis often accompanying extensive irradiation, surgical procedures may be very hazardous and consideration ought to be given to various possibilities incident thereto. Adolph Hartung, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Lee, D. H. K., Murray, R. E., Simmonds, W. J., and Atherton, R. G.: The Effect of Exercise in Hot Atmospheres upon the Salt-Water Balance of Human Subjects. *Med. J. Australia*, 1941, 2: 249.

In this human experiment several subjects were introduced into rooms of various temperatures and humidity, and, under conditions of marching and exercising by lifting heavy weights, the body chloride, protein, and water balance was studied. These experiments were as carefully controlled as possible. All subjects were weighed on a Sauter balance which weighs accurately to ½ gm. The woolen clothing, including gloves and socks worn by the subject, was carefully rinsed at four-hour intervals and the rinse water was used to measure chloride loss. The subject rinsed down his body at the same intervals in the clothing rinse, so that all of the chloride was saved. Urine studies were also made at these four-hour intervals. The atmospheres studied were "hot wet" and "hot dry"; the former 83.5° F., with a relative humidity of 87 per cent, the latter at 84.5° F., with a relative humidity of 38 per cent. It was found that in a hot dry atmosphere, regardless of the type of exercise performance, there was a marked reduction of sweat volume and chloride loss if saline solution was administered to the subject at frequent intervals. This was not true in the case of hot wet atmospheres. Sweat volume and chloride loss in a hot dry atmosphere measured from three to four times the amounts found in a hot wet atmosphere. Regardless of humidity, chloride and sweat loss is always greater during afternoon exercise periods than during morning periods.

The hydration of the subject as measured by blood-protein concentration was best maintained by small quantities of water given at fifteen-minute intervals in quantities sufficient to replace the fluid loss. The minimum of fluid loss in the most dehydrating conditions was 23 cc. per hour. The urine volume commenses to rise sharply at levels of body hydration below 100 per cent which suggests some tendency toward lessened retention of water at these levels. Under the atmospheric conditions studied it was thought that general bodily hydration may be maintained if raised to 102 per cent of the initial value in three weeks without special attention to the chloride intake.

There was some evidence to show that there may be some acclimatization of an individual to repeated exposures of hot dry atmospheres, as the chloride loss in the same subject was progressively less during the course of the experiments. Chloride loss of subjects who were natives of hot dry climates was less than in subjects newly introduced to the climate.

HOWARD A. LINDBERG, M.D.

Peer, L. A.: The Fate of Autogenous Septal Cartilage After Transplantation in Human Tissues. *Arch. Otolaryngol.*, 1941, 34: 696.

Otolaryngologists and plastic surgeons agree that septal cartilage is not as good for transplantation as rib cartilage. The general belief persists that septal cartilage is absorbed after transplantation and cannot be relied on as a material for filling saddle defects of the nose or to afford structural support for the nasal tip.

Peer has used autogenous septal cartilage grafts to correct small saddle depressions and to support the nasal tip in more than 500 cases and has failed to note gross absorption of the cartilage except when infection occurred after operation. Since his clinical experience differed from that of other plastic surgeons, he decided to check the accuracy of his observations by transplanting septal cartilage and removing it for microscopic examination at various intervals up to three years after transplantation.

Certain conclusions were reached:

Septal cartilage is hyaline cartilage and is similar in structure to rib cartilage. Autogenous rib cartilage without perichondrium, after transplantation in human beings either beneath the nasal skin or beneath the chest skin, survives as living cartilage. Autogenous septal cartilage without perichondrium, after transplantation in human beings, survives as living cartilage. It maintains the same gross bulk as when first transplanted and is not subject to absorption. Only smooth segments of septal cartilage are suitable for grafting purposes. Nicks, indentations, or fractures in the cartilage will be occupied by connective tissue after transplantation, and contracture of this connective tissue may distort or split the graft.

NOAH D. FABRICANT, M.D.

Goldblatt, H., Kahn, J. R., and Lewis, H. A.: Studies on Experimental Hypertension. Experimental Observations on Hypertension Associated with Unilateral Renal Disease; Effect of Occlusion of the Ureter on Experimental Hypertension Due to Unilateral Renal Ischemia. *Arch. Surg.*, 1941, 43: 327.

Constriction of one main renal artery in the dog causes a variable rise of the blood pressure, which persists for a variable period. Excision of the ischemic kidney results in a prompt fall of the blood pressure to normal. Similarly, in man, hypertension may be associated with unilateral renal disease, which presumably produces ischemia, and removal of the diseased kidney results in a fall of the blood pressure to normal if the other kidney is normal.

Occlusion of one ureter in the dog does not result in elevation of the blood pressure. Occlusion of the ureter performed at the same time that the main artery of the same kidney is constricted interferes with the development of the elevated blood pressure

of a dog with unilateral renal ischemia. After the blood pressure has become elevated because of constriction of one main renal artery, occlusion of the ureter of the same kidney causes a fall of the blood pressure to normal in from three to seven days. Constriction of both main renal arteries accompanied by occlusion of both ureters usually results in a moderate elevation of the blood pressure which persists until death of the animal in uremia. Occlusion of the ureter and constriction of the main artery of one kidney followed by contralateral nephrectomy also usually results in a moderate elevation of the blood pressure, which persists until death occurs in uremia. A hypertensive effect is, therefore, produced by constriction of the main artery of a kidney and occlusion of the ureter when no normal kidney is present.

A vasoconstrictor effect has been obtained by the Laewen-Trendelenburg technique with citrated plasma of the venous blood of kidneys in the presence of a constricted renal artery and occluded ureter, although the blood pressure of the animals was not elevated. No vasoconstrictor effect, but rather a dilator effect, was obtained with the plasma of venous blood from the contralateral, normal kidney, and of systemic venous blood. This indicates that the effect of occlusion of the ureter on a kidney with the main artery constricted is not to abolish the production of pressor substance but to interfere with the rate of entrance of pressor-producing substance from the kidney into the systemic circulation, or to diminish the amount produced. In either case, the failure of the blood pressure to become elevated as a result of the decreased amount of pressor-producing substance which enters the systemic circulation may also be due to the neutralizing effect of the contralateral normal kidney.

Some cases in which excision of a kidney with the ureter completely obstructed or excision of a kidney from which no urine was obtained was followed by a return of the blood pressure to normal have already been reported. The experiments indicate that this may not prove to be the rule and that in such cases excision of the kidney should be undertaken for the main purpose of removing the diseased organ rather than for possible cure of the hypertension. In all cases of contemplated unilateral nephrectomy it is desirable to determine that the other kidney is normal, as far as can be determined with the limited means available at present, before an obviously diseased, though still functioning, kidney is removed for the possible favorable effect on the elevated blood pressure.

SAMUEL H. KLEIN, M.D.

Price, P. B., Hanlon, C. R., Longmire, W. P., and Metcalf, W.: Experimental Shock; Effects of Acute Hemorrhage in Healthy Dogs. *Bull. Johns Hopkins Hosp.*, Balt., 1941, 69: 327.

This is the first article reporting a series of experiments, begun in 1938, in which the induction of acute circulatory depression in dogs by many methods was undertaken. The authors' hope was that a comprehensive experimental study with later analogous clinical studies would permit more satisfactory definition of the term "shock," and resolution of the condition into useful clinical types, each with its characteristic physiological and pathological picture and rational therapy.

The experimental methods used are described and diagrammed in detail.

The effects of hemorrhage are divided into four groups: (1) primary dynamic effects, (2) secondary pathological effects, (3) physiological compensatory mechanisms, and (4) regeneration of the blood elements.

Mention is made of the technical difficulties precluding the demonstration or measurement of anoxia, which is supposed to play so important a part in the production and perpetuation of shock. The authors conclude, however, (1) that progressively severe anoxia probably always occurs as a result of massive hemorrhage, and (2) that vital centers and organs do not appear to share in this general oxygen lack at first, though they probably do later.

Large scale vasodilatation, or rather relaxation of vasoconstriction, did not occur in their animals. It was noted that in the late stages of posthemorrhagic shock, dogs became extremely sensitive to blood loss, so that removal of a few cubic centimeters might precipitate collapse of the circulation; consequently, on the same principle, an imperceptibly small, general vasodilatation might upset an already precarious balance between the blood volume and the vascular bed capacity.

No atony, "stasis," or abnormal permeability of the capillaries was noted. Few of the expected varieties of functional and organic abnormalities were noted, possibly because "oxygenation is the function of blood most promptly and seriously disturbed by massive hemorrhage, and animals succumb from anoxia before other pathologic changes have had time to develop."

The compensatory physiological adjustments recorded in their observations are enumerated with short discussions after each heading. It was concluded that the effects of acute massive blood loss are sufficiently characteristic to constitute a distinctive type of experimental shock.

EUGENE J. AUDI, M.D.

Niño, F. L.: Mycetoma of the Feet Due to Monosporium Apiospermum in Argentina—Mycological Study of a Case (Micetoma podal maduromicótico con granos blancos por monosporium apiospermum en la República Argentina—estudio micológico de una observación). *Bol. inst. de clin. quir.*, Univ. de Buenos Aires, 1941, 17: 483.

Mycetoma of the feet is quite rare in Argentina considering the common custom of going barefoot or poorly shod. The infecting fungi consist of granules visible to the naked eye. These vary in color (yellow, white, red, or black) and in shape (round, ovoid, polycyclic, or vermicular). These characteristics aid in classifying the various types of myce-

Fig. 1. Mycetoma of the foot; photograph taken July 7, 1939.

toma. Chalmers and Archibald have grouped these fungi in two large groups: (1) the actinomycotic, and (2) the maduromycotic. The author reviews the literature and finds only 6 cases of the maduromycotic type reported in Argentina. The author's case is the only one with "white granules."

Fig. 2. Radiograph of the same foot taken November 23, 1939.

Fig. 3. Photomicrograph of a part of the culture of monosporium apiospermum. (×200).

A twenty-six-year-old Argentine bachelor stated that his illness began a year ago when he stepped on a pine needle while walking barefoot. On the following day there was swelling and pain which made it impossible to walk. When the patient presented himself for examination he had a deformity of the right foot which extended from the instep to the toes (Fig. 1). The foot had lost its normal appearance and looked spindle-shaped. The skin was hyperpigmented and presented sinuses at both malleolar regions from which exuded a serosanguineous discharge. On the plantar surface there were other sinuses and scars of closed sinuses. There was pain on palpation of both dorsal and plantar surfaces. There was no fluctuation or softening. In the right inguinal region there was a glandular enlargement the size of a pigeon's egg, hard and movable without periadenitis. The bone and joint tissues of the foot were involved in the infection. The general health and viscera were not affected. Gradually the foot became more swollen and painful. X-ray studies indicated severe bone destruction, especially of the scaphoid and the proximal portions of the metatar-

sals (Fig. 2). After failure of response to iodides and sulfanilamide the foot was amputated through the lower third of the tibia.

Examination of the seropurulent secretions from the sinus tracts revealed numerous round or ovoid, yellowish-white granules from 200 to 450 microns in diameter. Cultures were made on various media and revealed monosporium apiospermum (Fig. 3). Histological study of the infected tissues of the amputated foot revealed a papillomatous hyperplasia of the skin with hypertrophy of the dermis; numerous microabscesses with a predominance of neutrophil polynuclears; and intense infiltration of the skin and subcutaneous tissues with leucocytes, associated with intense proliferation of histiocytes.

There are numerous drawings and illustrations as well as a thorough bibliography of this uncommon infection. JACOB E. KLEIN, M.D.

Wu, C. J.: Hemolytic Streptococci in the Throats of Normal Individuals, with Reference to Their Serological Classification. *Chinese M. J.*, 1941, 60: 34.

The throats of 1,210 normal female adults in Shanghai, China, were cultured at intervals and the isolated hemolytic streptococci were grouped according to Lancefield's classification. The swabs were cultured on blood agar, and the hemolytic streptococci were then subcultured and stored for further study. Grouping was done on antigens prepared by methods of Lancefield and Fuller.

The total number of persons was divided into three groups. Of 1,220 swabs taken from the throats of 155 nurses, 13.4 per cent were positive in 86 nurses at one or more times. The remainder of the two groups were parturient women and only 5.9 per cent of the 1,568 cultures were positive. Eighty-six individuals were carriers, a rate of 7.9 per cent. There was a variation from 2 to 33.3 per cent per month among the nurses, and from 2.3 to 10 per cent among the patients, the height of the curve being in the winter months.

All but 10 of the strains were serologically grouped. No organisms of Groups E and K were found. The ratio of Group A to the rest was 30.1 per cent for all groups of patients. Positive cultures were studied for all groups to determine the possibility of mixed strains, and in only 3 cultures was more than one strain found at the same time. However, cultures repeated in the same persons revealed organisms of other groups in one-half the cases. This may represent a carrier state or repeated infection, a change in the serological make-up of the organism, or infection with another strain.

The carrier rates for the general population are about the same as found here. The incidence of Group A organisms is low. It may be significant in relation to the low incidence of scarlatina in Shanghai. It is to be expected that the hospital nurses show a higher rate, but this rate has been found to be lower than in other reported series.

HENRY P. ROYSTER, M.D.

Jacoby, F., Medawar, P. B., and Willmer, E. N.: The Toxicity of Sulfonamide Drugs to Cells *in Vitro*. *Brit. M. J.*, 1941, 2: 149.

Due to the fact that powdered sulfonamides are being used more commonly in the local treatment of wound infections, a knowledge of the relative toxicity of the various sulfonamides on normal tissue cells is important. In this study, the authors compare living-tissue cultures of fibroblasts, macrophages, and epithelial cultures, and the relative toxicity of sulfanilamide, sulfapyridine, and sulfathiazole on each type of cell. Proflavine was used as the standard of a severe tissue toxin. Not only were these sulfonamides ranked in order of their toxicity to living cells, but the magnitude of concentration which is lethal to them was also studied. It must be remembered that effective toxicity of any of the sulfonamides depends largely upon solubility and also the rate of transport from the site of local application. None of the sulfonamide drugs affects the coagulation of plasma, nor is it notably surface-active.

The technique employed in the study of the various cells is carefully described by the authors:

Action on fibroblasts. Sulfonamides in concentrations of approximately 1:100 in culture flasks bring division and migration of the cells to a standstill. Both are resumed within five hours when the drugs have been removed after an eighteen-hour treatment.

Sulfathiazole in a wide range of concentration from 1:10,000 exerts an appreciable inhibitory effect, but when taken in a 70 per cent saturated solution it fails to abolish mitosis completely. Recovery after eighteen-hours subjection is rapid and complete.

Sulfapyridine fails to effect mitosis or migration even in a 70 per cent saturated solution. In contrast, proflavine in dilutions lower than 1:1,000,000 exerts a total and irreversible inhibitory effect accompanied by cellular disintegration.

The order of increasing effective toxicity on the sulfonamides is simply that of increasing solubility, although sulfathiazole appears to be the least favorable for growth.

Action on macrophages. In a saturated solution of sulfapyridine (1:800), macrophages growing in a 40 per cent solution of serum were in no way inhibited by the drug. Sulfathiazole in a saturated solution (1:500) produced certain morphological changes in the cells which indicated a toxic effect. These disappeared entirely within one or two days after the cells were transplanted into fresh serum. A saturated solution of sulfanilamide (1:100) causes death and disintegration of the cells within twenty-four hours. Here again toxicity seems to depend on solubility. Proflavine caused complete cellular disintegration in a dilution of 1:1,000,000.

Action on epithelium. The effect of the sulfonamides on epithelial cells simulates to some extent that on fibroblastic growth. The epithelial sheets seem to grow with ease and invest crystal sulfapyridine and sulfathiazole. It is extremely unlikely that either of these drugs could retard the new growth of epithelium over a raw surface.

As a result of these experiments on tissue culture it is seen that all of the sulfonamides exhibit a very feeble inhibitory effect upon tissue cells, and that in choosing between one sulfonamide drug and the other for direct application, the relative effects on tissues can be disregarded in favor of relative specific bactericidal powers. HOWARD A. LINDBERG, M.D.

Bickel, G., and Guye, P.: Toxic Fever Due to Sulfathiazole (La fièvre d'intolérance au sulfathiazol). *Rev. méd. de la Suisse Rom.*, 1941, No. 8: 504.

Sulfathiazole (Cibazol) is not as toxic as the other sulfonamide derivatives. The more severe toxic complications due to sulfonamide therapy, such as agranulocytosis and jaundice, are very rare in treatment with sulfathiazole.

The two most frequent symptoms of toxicity caused by sulfathiazole are the fever and the exanthemas. The characteristics of the fever have never been thoroughly studied. It usually begins with the appearance of the cutaneous eruption and disappears with it. According to the authors, the fever was present in 1 of 6 patients who received from 4 to 6 gm. of sulfathiazole daily for six days or more. Usually the temperature started from seven to ten days after the beginning of the treatment and reached from 102 to 104 degrees in from twenty-four to forty-eight hours. Together with the fever a toxic conjunctivitis appeared in about 50 per cent of the cases. The cutaneous eruption may assume a different aspect, but it is practically always present in cases of fever due to sulfathiazole.

The fever, cutaneous eruption, and conjunctivitis are usually simultaneous. The appearance of only one or two of these symptoms speaks for an attenuated syndrome of toxicity. In the blood there is a moderate degree of leucocytosis and of eosinophilia. The increase in temperature after seven days together with cutaneous eruption and eosinophilia is very similar to the common findings in serum sickness. The fever from sulfathiazole occurs more frequently in pneumonia, usually at the end of the treatment, after 30 to 50 gm. of the drug have been administered. In these cases the temperature which is due to the sulfathiazole may be confused with a relapse of the disease. Frequently there is a direct passage of the pneumococcic fever into the therapeutic fever and the diagnosis may be difficult, but interruption of the treatment leads to a fall of the temperature within a few hours.

Sometimes the fever from sulfathiazole occurs suddenly during the second or third day of treatment. In these cases the patient had been treated previously with any drug of the sulfonamide group, and the authors speak of a real sensitization of the organism to the toxic action of the sulfathiazole. When the sulfathiazole treatment is continued at intervals for a long period of time, there is often a progressive passage from symptoms of toxicity to symptoms of sensitization.

The fever due to sulfathiazole usually disappears within forty-eight hours after discontinuation of the treatment. It may persist longer, together with other symptoms of toxicity, in patients with impaired renal function. The authors believe that when the life of the patient is still in danger, even in the presence of severe symptoms of toxicity, the sulfathiazole treatment should be continued. This viewpoint is not held by the majority of workers.

There is no specific treatment for the fever due to sulfathiazole, discontinuation of the drug usually being sufficient. The use of calcium (intravenously), of Vitamins B_1 and C, of nicotinic acid, and lactoflavine is advisable but these substances have no specific action against the toxic symptoms of sulfathiazole. C. L. PIRANI, M.D.

DUCTLESS GLANDS

Page, R. C., Russell, H. K., Schwabe, E. L., Matthews, C. S., and Emery, F. E.: Chronic Toxicity Studies of Diethylstilbestrol. Subcutaneous Implantation of Pellets in Rats. *Endocrinology*, 1941, 29: 230.

These investigators report their studies of intact and castrated adult female rats treated with implanted stilbestrol pellets weighing 50 and 200 mgm. The animals were killed at varying intervals and the tissue changes were studied. From the weight of the pellets removed at autopsy it was determined that enormous amounts of the drug had been absorbed (from 420 to 1,880 gamma daily).

Such huge doses, far in excess of physiological requirements, caused toxic changes in about one-third of the animals. These changes included definite pathology in 10 of 31 livers. Five livers showed toxic necrosis, 3 presented fatty degeneration, and 2 showed only cloudy swelling. Thirteen animals had endometrial hyperplasia; 12 had pyometra, and 2 demonstrated squamous metaplasia of the endometrium. One uterine myosarcoma was found. Toxic changes with cortical hemorrhages were seen in the adrenal glands of 11 of the animals. The peripheral blood of 1 animal showed a marked decrease in blood platelets. Bone-marrow smears demonstrated neutrophilic hyperplasia in 4 animals. Other changes included loss of weight, decreased ovarian weight, and marked increase in the pituitary weights. Histological examinations of the pituitary glands revealed a marked increase in chromophobe cells and a decrease in acidophil and basophil cells.
RULON W. RAWSON, M.D.

HOSPITALS; MEDICAL EDUCATION AND HISTORY

Perrin, T. G.: Concerning a Priority in Nosological Nomenclature. Carrión's Disease (Sobre una preterición en la nomenclatura nosológica. La enfermedad de Carrión.) *Gac. méd. de México*, 1941, 71: 514.

Perrin shows that, despite the well deserved priority of the term "Carrión's disease," which was proposed in 1886, the Bulletin of the Pan-American

Sanitary Office and a large number of authors use the names of Oroya fever and peruvian verruga to designate the bartonella infection, in the study of which Carrión sacrificed his life. It must be admitted that no absolute criterion has been followed in naming diseases, although there is at present a tendency to use pathopoietic or causal denominations whenever possible. The names of diseases show a wide variety of origins, and there are no terms that deserve more respect than those, based on a historical criterion and a moral feeling, which recall the name of the most meritorious investigator of the disease. In fact, a number of diseases are designated by such names and constitute a perennial tribute of admiration and gratitude. There is consequently no reason why the name of Carrión should not be used; but there are three reasons why it should be: Carrión is the author of an admirable study entitled "Data on Peruvian Verruga"; he forfeited his life in the investigation of the disease; and he has demonstrated the etiological unity of two clinical forms—Oroya fever which is the grave form, and peruvian verruga which is the benign form.

Daniel A. Carrión was a medical student at the University of Lima where the etiological identity of Oroya fever and verruga was then suspected. Wishing to clarify the infectious nature of verruga and, if possible, its etiological connection with Oroya fever, he insisted on being inoculated on both arms with blood from the verrucose tumors of a patient. After an incubation of twenty-one days, he developed Oroya fever instead of verruga: he made his own observations until the ninth day of the disease when he became incapable of continuing them personally; he died one week later.

Counterproof of the identity of the two diseases was obtained in the dog four years later, and Barton subsequently discovered the causal organism, which was called bartonella. Consequently, peruvian bartonellosis presents a septicemic form or grave fever, and a histioid, reticulohistiocytary, or eruptive form, which must both be included in the term of "Carrión's disease," proposed by Alcedán in 1886 and used two years later by Odriozola in his work published in Paris.

At present, among about 300 articles on the disease, only 54 written by authors of various nationalities use the name of Carrión in their title. The name of Barton has been immortalized not only in that of the germ which he has discovered but also in that of the new species isolated by other investigators. It would be unfair if the name of Carrión were relegated to the obscure limbo of forgotten illustrious men.

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